BSC-50-E

Battery powered RTU/Data Logger

User Guide

infinite

Contents

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1. Introduction

BSC-50-E is a GSM battery powered RTU/Data logger capable of using SMS for data and alarm transmission.

SMS messages are used for data transfer, alarm messages and periodical health messages (status messages) for verifying unit availability. The unit supports discrete recipient alarming for several users. SMS messaging includes:

1. Event driven SMS transmission in case of an alarm condition (Alarm messages).
2. Periodical SMS transmission for availability verification (Status messages).
3. Periodical SMS transmission for logged data transfer.

The unit comprises 4 digital inputs, 2 analog inputs and a transducer excitation output.
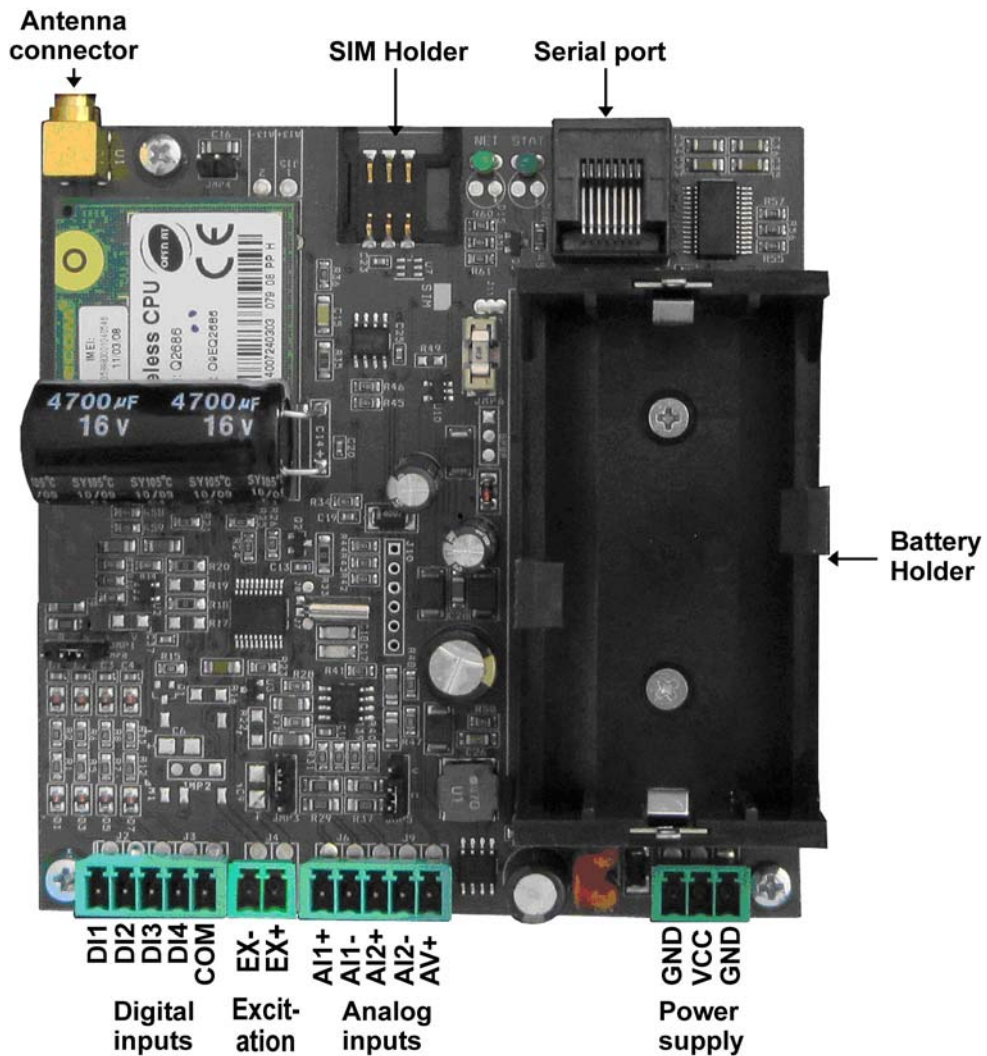
2. Operation modes

Modes of operation include:

1. Power network independent battery operation.
2. External power adaptor supply operation for unit setup only.

3. Setup

3.1 Packing list

1. BSC-50-E unit
2. Lithium Thionyl Battery

3.2 Hardware setup

3.2.1 Jumper settings
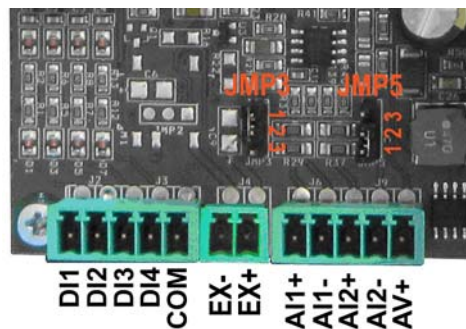
JMP3: Analog input 1 mode:

Position C (1-2): Current 0-20/4-20mA

Position V (2-3): Voltage 0-1V

JMP5: Analog input 2 mode:

Position C (1-2): Current 0-20/4-20mA

Position V (2-3): Voltage 0-1V

3.2.2 SIM card & Battery installation

- Open the unit enclosure by unscrewing the plastic screws on the enclosure's top.
- Insert the SIM card into the SIM card holder.
- Install the Lithium battery.

    WARNING: Pay attention to the correct polarity! The right polarity is marked up on the battery holder. Inverse polarity will stress the low power, low voltage rectifying circuits in the unit and will lead to hardware failure.

3.2.3 Wiring the digital inputs
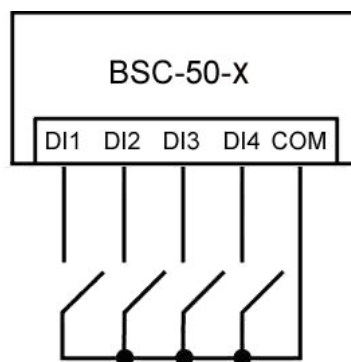
3.2.4 Wiring the analog inputs

BSC-50-E incorporates 2 analog inputs with 10 bit resolution.

The input signal mode (voltage or current) is selectable by means of jumpers JP3 for AI1 and JP5 for AI2 (see 3.2.1).

Voltage input: JMPx in position 'V'.
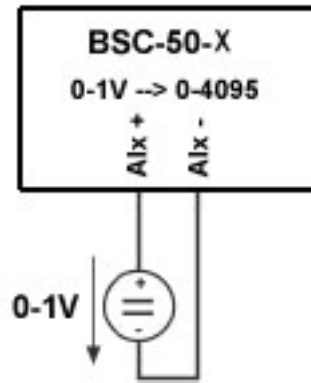
Current input: JMPx in position 'C'.
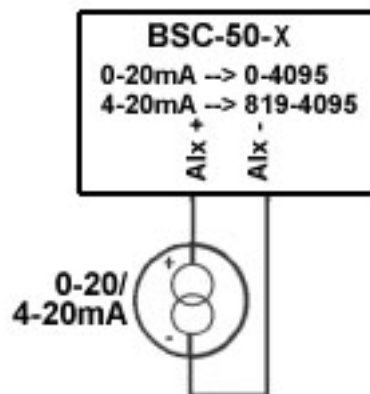
3.2.5 Wiring the Excitation output

BSC-50-E incorporates a 12VDC excitation output to supply power to external analog transducers. Low power 0-1V transducers are recommended for preserving longer battery lifetime.

The sensor supply is switched according to the analog input sampling rate (one sample per minute). The unit performs 6 consecutive readings for every sample, thereby neglecting the maximum and minimum values and calculates the average of the remaining four values.

0-1V transducer:
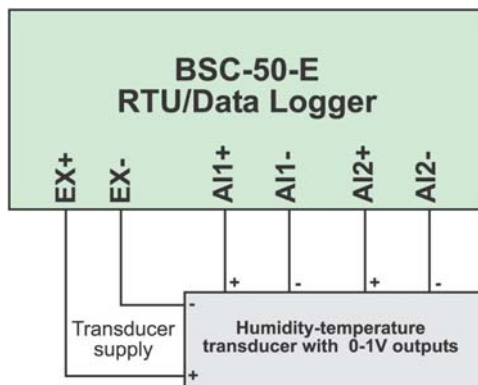
Two Wire 0-20/4-20mA Sensor (BSC-50-E):
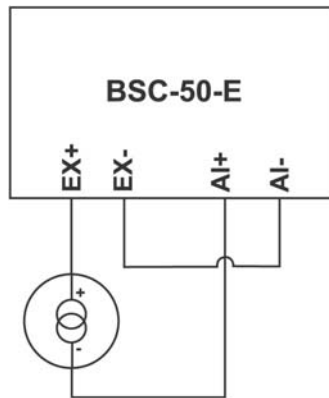
Four Wire 0-20/4-20mA transducer:
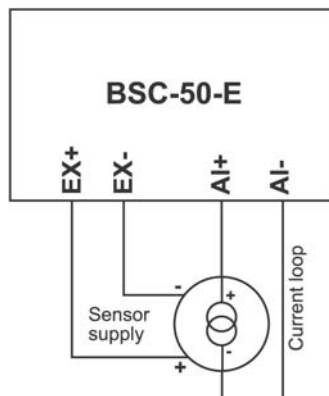
3.3 Configuration commands

3.3.1 Configuring a digital input for alarming

The DI configuration command structure is:

`1100,n,s,a,d`

1100:   Command ID

n: DI number (1-4)

s: DI name (Text: 0-15 characters, may include space characters)

a: Transition selection (0: No alarm, 1: positive, 2: negative, 3: Both)

d: Delay time in seconds (0-255)

3.3.2 Configuring an analog input for logging & alarming

The AI configuration command structure is:

`1200,n,s,ssl,ssh,sl,sh,al,ah,u,d`

1200:   Command ID

n: AI number (1-2)

s: AI name (Text: 0-15 characters, may include space characters)

ssl: Sensor scale low (Row value 0-4095)

ssh: Sensor scale high (Row value 0-4095)

sl: User scale low

sh: User scale high

al: Alarm limit low in physical scale values

ah: Alarm limit high in physical scale values

u: Physical unit

d: Alarm delay in minutes

The following table contains the scale and sensor low/high values for the common ranges:

Transducer	Scale	Sensor low	Sensor high	Gain
-	0-1V	0	4095	4.095
-	0-20mA	0	4095	4.095
-	4-20mA	819	4095	4.095
AD592	-25°C - 95°C	2742	4069	4.095

*AD592 Requires a 2.7K resistor between AI+ and AI-. Set for voltage measurement.

Three additional parameters refer to all analog inputs:

AI Alarm Deadband

The parameter defines the alarm deadband (hysteresis) for the analog channels. Alarm deadband is a small range of the total scale, where the alarm state remains indifferent, by registering the last value.

`1290,d`

d: 0-50 for an alarm deadband of 0-5% in steps of 0.1%.

AI sampling delay

The parameter defines an idle period between switching on/off the excitation and registering the measurements of the analog inputs. This option should be set

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according to the transducer power up delay for stable reading. **The value of this parameter affects strongly the battery life.**

```
1291,d
```

d: 0-255 sec

AI sampling interval

The parameter defines the AI sampling period. **The value of this parameter affects strongly the battery life.**

```
1292,p
```

p: 1-255 min

AI logging rate

The parameter defines the AI logging rate.

```
1300,n
```

n: 0-255, number of samples.

n=0 disables logging.

Example:

1300,4 instructs the unit to log every fourth sample. If the sampling rate is every 15 minutes then the unit will log one sample per hour.

Sending rate

The parameter defines the logged data transmission rate. **The value of this parameter affects the battery life.**

```
1310,p
```

p: 0-255 hours

3.3.3 Setting alarm message texts

You can set up to 128 custom text messages to be announced in an SMS alarm as a descriptive reason instead of the default text. The command for configuring a text message is:

```
0630,ID,s
```

0630: Command ID

ID: Message ID (1-128)

s: Message text (0-64 characters, may include space characters)

3.3.4 Selecting alarm messages for a DI event

Two alarm messages can be associated to a DI alarm event. One for M2M recipients (e.g. containing an ASCII command for a remote SCOM device) and a second for phone recipients:

```
110x,n,ID
```

110x: Command ID, 1102 for M2M, 1101 for Phone recipients

n: Input number (1-4)

ID: Message ID (1-128)

3.3.5 Selecting alarm messages for an AI event

Two alarm messages can be associated to a DI alarm event. One for M2M recipients (e.g. containing an ASCII command for a remote SCOM device) and a second for phone recipients:

```
120x,n,ID
```

120x: Command ID, 1202 for M2M, 1201 for Phone recipients

n: Input number (1-4)

ID: Message ID (1-128)

3.3.6 User setup

Up to 20 SMS users can be declared in a BSC-50-E unit. Only declared users can interact (send, receive SMS) with the unit. BSC-50 features three levels of user rights. The following options can be configured for each user:

1. User administration option. Status messages are sent only to users with administration rights.

2. Device configuration option. Represents the right to configure the BSC-50 device.

3. Alarm SMS recipient option. Marks a user as an SMS alarm recipient.

A new user can be created using the command:

`0500,id,n,p,c1,c2,c3`

0500:   Command ID

id: User ID (1-20)

n: User name (0-15 characters)

p: Phone number (3-15 characters)

c1:   User administration rights (0 for 'No' 1 for 'Yes')

c2:   Device configuration rights (0 for 'No' 1 for 'Yes')

c3:   Alarm SMS recipient (0 for 'No' 1 for 'Yes')

c4:   M2M, User is a M2M device (0 for 'No' 1 for 'Yes')

Additional commands to configure, and delete a user are available for user administration.

3.3.7 Defining event specific alarm recipients

A special command is available to define the SMS recipients for each alarm event. M2M recipients will receive the associated M2M message, while phone recipients will receive the respective text message (See 3.2.3).

`1103,n,id`

1102:   Command ID

n: DI number (1-4)

id: User ID (1-20)

3.3.8 Naming the unit

You can specify a unit name for identification purposes. The unit name will be used in the alarm and status SMS messages. The command to name the unit is:

`0300,Name`

0300:   Command ID

Name: Device name (up to 15 characters)

3.3.9 Setting the Status message period

`0650,n`

0650:   Command ID

n: Period (0-99), [Days], Value '0' disables status messaging, Default: 7

3.3.10 Status message idle period

`0651,n`

0650:   Command ID

n: Period (0-180), [sec], Default: 120

Use this parameter to set an idle time period after the Status message transmission. The GMS Modem will remain connected to the GSM Provider network for this period, waiting for receipt of SMS containing configuration updates.

3.3.11 Setting the number of transmission retries

This setting represents the number of retries after a SMS transmission failure.

```
0640,n
```

0640:   Command ID

n: Send retries (0-99), Default: 3

3.3.12 Setting the delay between retries

```
0641,n
```

0641:   Command ID

n: Delay between retries (0-65535), [sec], Default: 10

3.3.13 Factory settings

```
0183,0183
```

0183:   Command ID

0183:   Extra command argument

3.4 Programming the unit

Power up the unit connecting the external DC power adaptor. Program execution is suspended. The Status LED turns off. The GSM LED will start blinking, indicating connection to the GSM provider's network. There are three ways to program the unit:

1. Sending SMS containing the appropriate commands to the unit. The semicolon character ';' acts as command delimiter.
2. Connecting the unit to a PC and using a terminal program to pass the ASCII commands to the unit, according to the scheme: atsms="ASCII command". The terminal settings should be: Baud rate: 115200 bps, Data bits: 8, Parity: none, Stop bits: 1, Flow control: Hardware.
3. Connecting the unit to a PC and using the WA Manager software. This way is the most easy to use.

Configuration commands can be sent to the unit both during program stop (external power adaptor operation) and also in the idle time after a status message has been transmitted (see 3.3.10).

4. Operation

4.1 Alarm Messaging

The following is a typical Alarm message:

Message contents	Item description
BSC-50	Unit Name
ALARM MESSAGE	Fixed Header
DI 1	Input Name
Earth Fault	Alarm message

4.2 Status Messaging

The following is a typical Status message:

Message contents	Item description
BSC-50	Unit Name
STATUS MESSAGE	Fixed Header
ON	Operation Status
TOTAL:	n
SQ:	ERR:x, MIN:y, MAX:y, AVG:y
BER:	ERR:x, MIN:y, MAX:y, AVG:y

SMS Status messages are sent only to users with the Admistnistrator rights.

The Status message contains the information regarding the GSM signal quality.

The information includes the following fields:

TOTAL: n, number of samples

SQ: Signal Quality: ERR: x=number of invalid samples, MIN, MAX, AVG: minimum, maximum and average values y=0-31

BER: Bit error rate: ERR: x= number of invalid samples, MIN, MAX, AVG: minimum, maximum and average values y=0-7

4.3 Data transfer

The following is a typical data transfer message:

Message contents	Item description
BSC-50	Unit Name
DATA	Fixed Header
DATE/TIME	ddmmyyyyhhmm
Data contents	DR,ACHN,vAI11,vAI21,.., vAI1n,vAI2n

One or more SMS messages are sent according to the data volume.

DATE/TIME: Time stamp of the first measure

dd: day, mm: month, yyyy: year, hh: hour, mm: minute.

DR: Sampling rate x Logging rate [min]

ACHN: 1 or 2, Number of logged AI channels.

vAI1n,vAI2n: Measurement values in user scale.

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5. Technical characteristics

Power supply	Internal 13.0 Ah Lithium Thionyl battery External 9-18V power adaptor
Temperature Operation Storage	 -20 to 55 ºC -45 to 85 ºC

Current draw
  Standby operation
  Messaging
	
	40 uA
	Average 45 mA
	Peak 2A

Digital inputs	4, potential free contact inputs
Analog inputs	2, 0-1V/0-20/4-20mA, 10 bit resolution
Excitation	12VDC/200mA max
Serial port	RS232C, 9600 to 115200 bps
Indications	2 LED, GSM network status, Program status indication (Run/Stop)
GSM Modem	Quad band (850/900/1800/1900MHz) Sierra Wireless Q268x series
Protection	IP66
Dimensions	130 x 130 x 75 mm
Weight	0.5 kg

6. Battery life

The table below is given to provide an example of the consumption of the unit for different operational parameter values.

Excitation current [mA]	Sampling rate [min]	Sampling delay [sec]	Sending rate [hours]	Battery life [Years]
1	15	1	24	10.5
1	5	1	24	9.3
25	15	1	24	8.9
25	5	1	24	6.4
1	1	1	24	5.6
1	15	5	24	8.4
1	5	5	24	5.6
1	1	5	24	1.9
25	5	5	24	2.3
1	15	1	12	9.2
1	15	1	6	7.5

In order to extend battery life:

1. Set the sampling rate to a low frequency value, e.g. 10-15 min.

2. Prefer to use low power 0-1V transducers with supply current <1 mA and fast response (< 1 sec). Avoid to use 020/4-20mA transducers.

3. Set the sending rate to a value >= 24 (data transmission once per day).

4. Select a proper antenna for assuring good RF signal quality to minimize transmission retries.

7. Command summary

Cmd	Description	Syntax	Comments
0171	Reset Device	cmd	
0183	Set Factory Defaults	cmd,cmd	
0195	Clear Character Translation	cmd,cmd	
0300	Set Device Name	cmd,s	s: device name
0350	Set Device mode PROGRAM	cmd	
0351	Set Device mode RUN	cmd	
0500	Create User	cmd,id,n,p,c1,c2,c3,c4	id: user id (1-max users), n: name, p: phone number, c1-c4: user configuration
0501	Delete User	cmd,id	id: user id (1-max users)
0502	Set User Configuration	cmd,id,c1,c2,c3,c4	id: user id (1-max users), c1-c4: user configuration
0600	Set Remaining SMS Alarm Limit	cmd,l	l: remaining SMS alarm limit
0601	Cancel Remaining SMS Alarm	cmd	
0605	Set Remaining SMS Counter	cmd,v	v: counter value
0610	Set Verbose Responses	cmd	
0611	Cancel Verbose Responses	cmd	
0620	Set Response SMS	cmd	
0621	Cancel Response SMS	cmd	
0630	Set Alarm Message Text	cmd,id,s	id: alarm message id (1-max alarm messages), s: alarm message text
0640	Set Send Retries	cmd,n	n: send retries
0641	Set Send Delay	cmd,d	d: send delay
0650	Set Alive Period	cmd,p	p: alive period (days)
0651	Set Idle Time After Alive SMS	cmd,t	t: idle time (seconds)
0660	Merge Concurrent Alarms	cmd	
0661	Unmerge Concurrent Alarms	cmd	
0670	Set Language	cmd,l	l: language (1:English, 2:Greek)
0690	Set Character Translation	cmd,a,g	a: ASCII character set code, g: GSM character set code
0783	Set GSM PIN	cmd,p	p: GSM PIN
0790	Show Status Messages	cmd	

Cmd	Description	Syntax	Comments
0791	Hide Status Messages	cmd	
1100	Set DI Configuration	cmd,n,s,a,d	n: DI, s: name, a: alarm mode, d:alarm delay
1101	Set DI Person Alarm Messages	cmd,n,id1,id2	n: DI, id1/id2: negative/positive alarm message id
1102	Set DI M2M Alarm Messages	cmd,n,id1,id2	n: DI, id1/id2: negative/positive alarm message id
1103	Set DI Alarm Recipient	cmd,n,id	n: DI, id: user id (1-max users)
1109	Clear DI Alarm Recipients	cmd,n	n: DI
1110	Clear DI Configuration	cmd,n	n: DI
1200	Set AI Configuration	cmd,n,s,ssl,ssh,sl,sh,al,ah,u,d	s: name, ssl/ssh: sensor scale l/h, sl/sh: scale l/h, al/ah: alarm l/h, u: unit, d:alarm delay
1201	Set AI Person Alarm Messages	cmd,n,id1,id2	n: AI, id1/id2: low/high alarm message id
1202	Set AI M2M Alarm Messages	cmd,n,id1,id2	n: AI, id1/id2: low/high alarm message id
1203	Set AI Alarm Recipient	cmd,n,id	n: AI number, id: user id (1-max users)
1204	Set AI Low Alarm Limit	cmd,n,al	al: low alarm limit
1205	Set AI High Alarm Limit	cmd,n,ah	ah: high alarm limit
1209	Clear AI Alarm Recipients	cmd,n	n: AI number
1210	Clear AI Configuration	cmd,n	n: AI number
1290	Set AI Dead Band	cmd,d	d:dead band
1291	Set AI sampling delay	Cmd,p	p: 0-255
1292	Set sampling rate	cmd,p	p: 1-255
1300	Set logging period	cmd,p	Nr. of samples, p: 0-255
1310	Set Sending rate	cmd,p	1-255
1600	Set RTC Time	cmd,d,m,y,h,n,s	d: day, m: month, y: year, h: hour, n: minutes, s: seconds
2000	Get Device Status	cmd	
2008	Get Signal Quality	cmd	
2150	Get Last Error Report	cmd	
2160	Get Event Log Entries Number	cmd	
2161	Get Event Log Entry	cmd,n	n: event number (1-max events)
2300	Get Device Name	cmd	
2500	Get User Info	cmd	

Cmd	Description	Syntax	Comments
2600	Get Remaining SMS Alarm Limit	cmd	
2601	Get Remaining SMS Alarm Status	cmd	
2605	Get Remaining SMS Counter	cmd	
2610	Get Verbose Responses	cmd	
2620	Get Acknowledge Status	cmd	
2630	Get Alarm Message Text	cmd,id	id: alarm message id (1-max alarm messages)
2640	Get Send Retries	cmd	
2641	Get Send Delay	cmd	
2650	Get Alive Period	cmd	
2651	Get Idle Time After Alive SMS	cmd	
2660	Get Alarm Merge Status	cmd	
2670	Get Language	cmd	
2690	Get Character Translation	cmd	
2691	Get ASCII codes	cmd,s	s: ASCII codes of this string's characters are dumped to serial port
2710	Get Available Alarm Message ID	cmd	
3110	Get DI Settings	cmd,n	n: DI
3210	Get AI Settings	cmd,n	n: AI
3290	Get AI Dead Band	cmd	
3291	Get AI Sampling delay	cmd	
3292	Get sampling rate	cmd	
3300	Get logging rate	cmd	
3310	Get sending rate	cmd	
3600	Get RTC Time	cmd	
5100	Get Current AI/DI Values	cmd	