Operating Manual

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SomatCR CAN_Reference

A3717-1.0_en/de/fr

HBM

1 Overview

The Device MC1609 CANopen is operating as a Slave-Device in a CANopen network. All Settings concerning to configuration will be allowed with commercial CANopen software tools.

- RevisionNumber 0x000200x (Hardware Rev. B): one device with 16 thermo channels

The following CANopen standard documents apply:

- Application Layer and Communication Profile: DS301 V4.02
- Device Profile Measuring Devices and Closed-Loop Controllers
  DS404 V1.2
- Layer Setting Services and Protocol (LSS): DS305 V1.1.1

2 Range of Functions

2.1 DS301 V4.02 – Communication Profile

The following objects will be supported by MC1609:

1003h	Pre-defined Error Field
1005h	COB-ID SYNC – Receiver
100Ch	Guard Time
100Dh	Live Time Factor
1017h	Producer Heartbeat Time
1010h	Store Parameters
1011h	Restore Default Parameters
1014h	COB-ID EMCY (Emergency Object)
1200h	1st Server SDO Parameter
1800h/1A00h	1st transmit PDO Parameter / 1st transmit PDO mapping
1801h/1A01h	2st transmit PDO Parameter / 2st transmit PDO mapping
1802h/1A02h	3st transmit PDO Parameter / 3st transmit PDO mapping
1803h/1A03h	4st transmit PDO Parameter / 4st transmit PDO mapping

2.1.1 Guard Time - Live Time Factor - Heartbeat-Producer

The objects *GuardTime (100Ch)* and *LifeTimeFactor (100Dh)* for Time-Guarding and Live Time Factor to-

gether with the object *ProducerHeartBeatTime (1017h)* for the Heartbeat-Producer will be supported and can be optionally applied.

2.1.2 Store / Restore

To store adjusted configurations into the device the objects *Store Parameters (1010h)* and *Restore Default Parameters (1011h)* will be supported. Therefore the configurations are available instantly after *Reset* and *Power On* respectively. To prevent storing by mistake the signature *"save"* has to be written into the *Store Parameters* object. For loading the default configuration the signature *"load"* has to be written into the *Restore Default Parameters* object. It's the identical concept.

Store Parameter

For storing the configuration the *Store Parameter object (1010h)* Sub-Index 1 will be used. This Sub-Index refers to all parameters which can be stored.

MC1609 stores all parameters with the attribute "read-write":

1005h	COB-ID SYNC
100Ch	Guard Time
100Dh	Life Time Factor
1014h	COB-ID EMCY
1017h	Producer Heartbeat Time
1800h	Transmit (TX) PDO1 Parameter
1801h	Transmit (TX) PDO2 Parameter
1802h	Transmit (TX) PDO3 Parameter

1803h	Transmit (TX) PDO4 Parameter
1A00h	Transmit (TX) PDO1 Mapping
1A01h	Transmit (TX) PDO2 Mapping
1A02h	Transmit (TX) PDO3 Mapping
1A03h	Transmit (TX) PDO4 Mapping
6110h	AI Sensor Type
61A0h	AI Filter Type
61A1h	AI Filter Constant

Restore Default Parameters

For restoring the Default-Parameters the Restore *Default Parameters (1011h)* Sub-Index 1 will be used. This Sub-Index refers to all parameters which can be restored.

Depending on the Node-ID the Default Parameters are focused on the pre-defined Connection Set.

2.1.3 Emergency Object (EMCY)

Error Treatment is covered by the Emergency Object. Internal Errors with a high priority will be reported to the network. Error Codes will be completed by Special Codes of DS404 V1.2 (e.g. broken Sensor).

2.1.4 PDO

The Transmit PDO-mapping for DS404 V1.2 *described in Tab. 2.1*:

PDO	Description
1st transmit PDO	analogue input values
2nd transmit PDO	effective controller output
3rd transmit PDO	alarm values
4th transmit PDO	digital input values
receive PDOs	not relevant for MC1609

Tab. 2.1 Transmit PDO Mapping for DS404

MC1609 uses all four available Transmit PDOs in each case.

Because of masking the not required functional blocks in *Device Type (1000h)* object the use of just the first Transmit PDO will be determined. Therefore the further three Transmit PDOs are available again and can be used for the MC1609.

PDO Configuration

There are two possibilities, which can be selected for each PDO. This so-called Transmission Type will be determined in the *Transmit PDO Communication Parameter* object.

- Synchronous Sending:
  On this a SYNC signal on the network is required. With a value between *1 and 240* the number of *SYNC signals* can be determined before the next Transmit PDO will be transferred.
- Asynchronous Sending:
  type 255: An Event Time (free-running) can be used for periodical sending.
  This time is many times greater than 1ms. For the MC1609 the Event Time can be configured 100ms and higher.

PDO-Mapping

Dynamical PDO-Mapping is supported.

Default-Mapping for Transmit PDO1:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Channel 1		Channel 2		Channel 3		Channel 4	
0x71300110		0x71300210		0x71300310		0x71300410	

Default-Mapping for Transmit PDO2:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Channel 5		Channel 6		Channel 7		Channel 8	
0x71300510		0x71300610		0x71300710		0x71300810	

Default-Mapping for Transmit PDO3:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Channel 9		Channel 10		Channel 11		Channel 12	
0x71300910		0x71300A10		0x71300B10		0x71300C10	

Default-Mapping for Transmit PDO4:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Channel 13		Channel 14		Channel 15		Channel 16	
0x71300D10		0x71300E10		0x71300F10		0x71301010	

2.2 DS404 V1.2 – Device Profile

This Device Profile serves for measurement device specifications.

2.2.1 Object 1000h: Device Type

The Device Profile (here: DS404) and functional blocks of it, which were supported by MC1609, will be encoded in the *Device Type (1000h)* object.

MSB			LSB
Additional Information		Device Profil Number	
(see table below)		404	
31	16	15	0

Tab. 2.2 Stucture of Device Type

Bit	Description
16	digital input block
17	analogue input block
18	digital output block
19	analogue output block
20	controller block
21	alarm clock
22	reserved
..	..
31	reserved

MC1609: 0x00020194

2.2.2 Analogue Input Block

The analogue Input Block describes how to convert raw-values (Field Values) into process-values (Process Values).

In the case of MC1609 the thermo voltage will be fetched as raw-values and with help of scaling-values converted into process-values. These values are using the physical unit °C with one decimal digit. All scaling-values are predefined and can't be modified.

Supported Objects

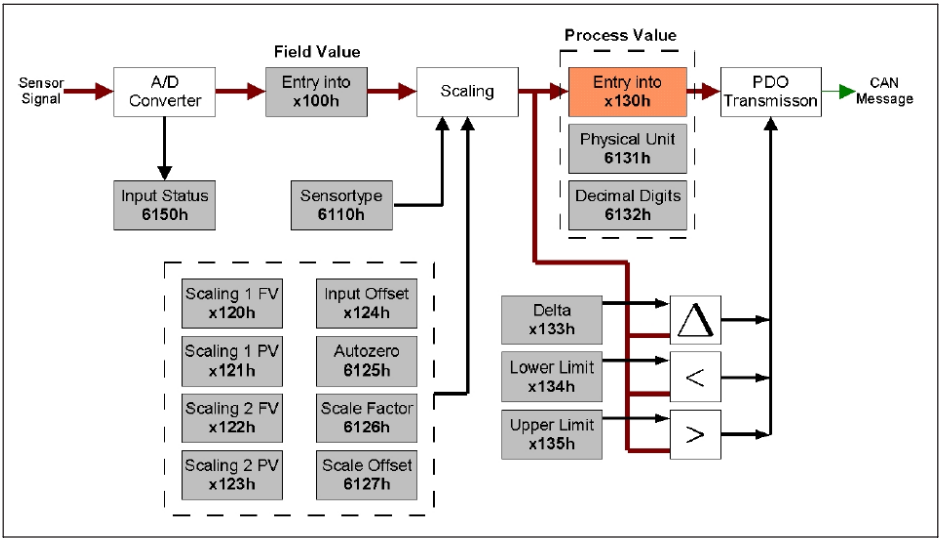

Fig. 2.1 Structure of analogue Measuring Channel

The MC1609 supports the following objects of Fig. 2.1:

Index	Object Code	Description	Data Type	Acc	PDO mapping	Cat-egory	Default
7100h	ARRAY	AI Input FV	Unsigend16	ro	No	C/O	0
Sensor							
6110h	ARRAY	AI Sensor type	Unsigend16	rw	No	O	2
Filter							
61A0h	ARRAY	AI Filter Type	Unsigend8	rw	No	O	0
61A1h	ARRAY	AI Filter Constant	Unsigend16	rw	No	O	0
Scaling							
7120h	ARRAY	AI Input Scaling 1 FV	Unsigend16	ro	No	O	0
7121h	ARRAY	AI Input Scaling 1 PV	Sigend16	ro	No	O	-1000
7122h	ARRAY	AI Input Scaling 2 FV	Unsigend16	ro	No	O	65535
7123h	ARRAY	AI Input Scaling 2 PV	Unsigend16	ro	No	O	13720
7124h	ARRAY	AI Input off-set	Unsigend16	ro	No	O	0
Process value reading							
7130h	ARRAY	AI Input PV	Sigend16	ro	Possible	C	0
6131h	ARRAY	AI Physical unit PV	Unsigned32	ro	No	C	0x002 D0000

Index	Object Code	Description	Data Type	Acc	PDO mapping	Cat-egory	Default
6132h	ARRAY	AI Decimal digits PV	Unsigned8	ro	No	C	1
legend Acc = access type rw = read-write, ro = read-only, wo = write-only, C = conditional, O = optional. FV = field value, PV = process value							

Tab. 2.3 Object of analogue Input Blocks

For more information about objects of analogue Input Blocks refer to DS404 V1.2 page 30

Process-Value

The *Input PV (7130h)* object contains the result of the Input Scaling Blocks and indicates the measured magnitude in its physical unit (*Physical Unit PV, 6131h*). The *Decimal Digits PV (6132h)* object displays the decimal space.

Example - for MC1609 (Channel 2):

Index	Sub-Index	Description	Value
7130h	2	AI Input PV	7985
6131h	2	AI Physical Unit PV	002D0000h
6132h	2	AI Decimal Digits PV	1

Fig. 2.2 Example of Process Values

--> 798,5 °C

°C, decimal space of one – these values can't be modified (read-only)

Scaling of Measuring Values

The conversion from field value to process-values is generally described as a linear transformation. This is defined by two pairs of field value and corresponding process value *(InputScaling1FV / InputScaling1PV* and *InputScaling2FV / InputScaling2PV*) called calibration point 1 and 2.

Therefore the achieved transformation can be shifted by an additional Input Offset. *Refer to Fig. 2.3 and Fig. 2.4 respectively.*

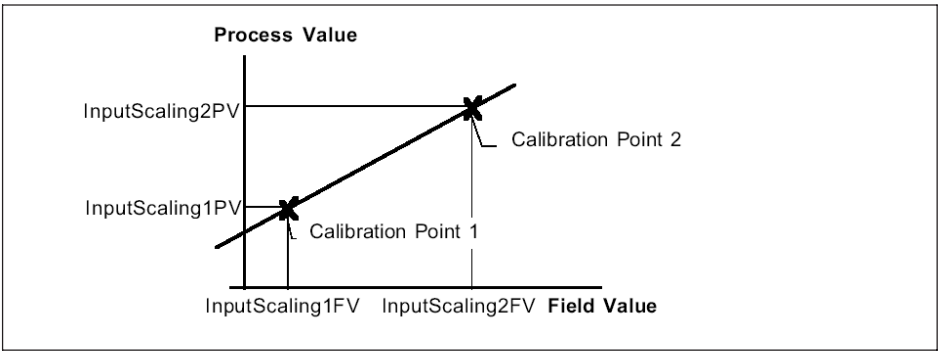

Fig. 2.3 Scaling

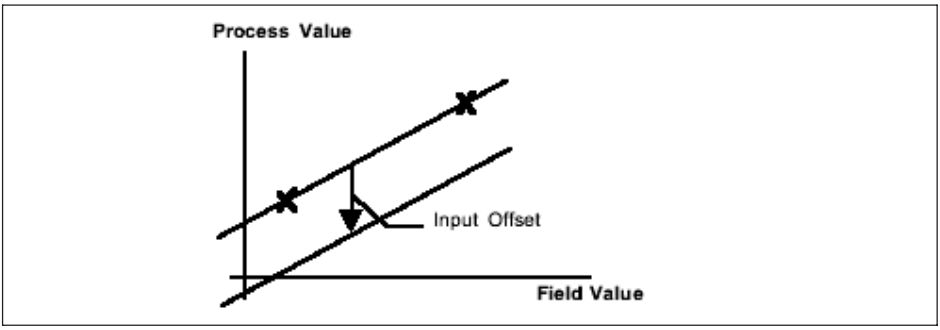

Fig. 2.4 Offset

In case of MC1609 the field value '0' is equal to a temperature of -100°C. A field value of '65535' corresponds to +1372,0°C. As a result the scaling-values will be outlined in Tab. 2.4.

Example – for (Channel 2):

Index	Sub-Index	Description	Value
7100h	2	AI Input FV	40000
7120h	2	AI Input Scaling 1FV	0
7121h	2	AI Input Scaling 1PV	-1000
7122h	2	AI Input Scaling 2FV	65535
7123h	2	AI Input Scaling 2PV	13720
7124h	2	AI Input Offset	0

Tab. 2.4 Example of Scaling

As a consequence the conversion from field-value to process-value results in the following formula:

$$ProcessValue = FieldValue * \frac{14720}{65535} - 1000$$

From this follows that:

$$40000 * \frac{14720}{65535} - 1000 = \mathbf{7985}$$

The scaling-values for are all read-only.

Filter

To calculate the process-value the MC1609 supports two different filter types, which are defined by DS404 V1.2. This filter type will be defined in the *Filter Type (61A0h)* object.

These different types will be displayed by Tab. 2.5:

Value	Description
0	No filter
1	Moving Average
2	Repeating Average
3 .. 99	reserved
100 .. 255	Manufacturer specific

Tab. 2.5 Filter Types

Moving Average

There has to be calculated the difference between the current value (internal sampling rate 1ms) and the previous calculated average value. This difference has to be divided by a filter constant (*Filter Constant, 61A1h*) and added to the previous calculated sum.

$$Value_N = Value_{N-1} + \frac{Input - Value_{N-1}}{\vartheta}$$

ϑ = Filter Constant

Repeating Average

At any reading of the current value (every 1ms, internal sampling rate) the value has to be added to the sum. At the moment of sending a PDO an average value over the number of added values will be calculated. Following the sum will be set to zero for the next calculation. To hold the averaging in sync with sending the PDO, the filter constant will be ignored.

The sum will be added between two sending cycles and calculated at the moment of sending. In case of the *TransmissionType* 255 the *EventTime* is conform to the filter constant N. With the *TransmissionType* 1-240 it corresponds to the *SYNC-Interval* multiplied by the *Trans-*

missionType of the filter constant N. (SYNC-Interval x TransmissionType of filter constant N)

$$Value = \frac{\sum_{n=1}^{N} Input_n}{N}$$

Tip

The Repeating Average will be generated until 1000ms maximum. From that moment it will be switched to Moving Average.
The value '0' will be ignored for the filter type. In this case internal the Repeating Average will be used.

2.3 DSP305 V1.1.1 – Layer Setting Services

The Layer Setting Services are implemented at DS305 V1.1.1.

With them it is possible to configure the Node-ID and Bitrate over the CANopen network. So there's no need for a switch at the device.

Following values can be configured and saved over the CANopen network:

- Node-ID (1 to 127)
- Bitrate (10kBit/s, 20kBit/s, 50kBit/s, 125kBit/s, 250kBit/s, 500kBit/s, 800kBit/s, 1MBit/s)

Setting of Node-ID

During the setting of the Node-ID the following has to be taken into account:

After changing the Node-ID the COB-IDs of EMCY, SDO, TPDO1, TPDO2, TPDO3 and also TPDO4 will be adjusted to the pre-defined Connection Set.

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