Bitric P

Industrial Controller
RS 485 interface description

Interface description 42/61-42 EN Rev. 01

ABB

Contents

Seite

Instructions ... 3

1 Description ... 4

2 Data transfer ... 5
2.1 Telegram characters ... 5
2.2 Permitted addresses ... 5

3 Outline specification ... 6
3.1 Telegram formats ... 6
3.2 Transmission rules ... 6
3.3 Calculating the checksum FCS ... 7
3.4 Calculating values ... 7

4 Telegrams ... 8
4.1 Telegrams for the operation ... 8
4.1.1 Presence interrogation ... 8
4.1.2 Standard interrogation, binary signals ... 8
4.1.3 Standard interrogation of analogue and binary values ... 9
4.1.4 Interrogation of up to eight addressable analogue values ... 10
4.1.5 Interrogation of up to eight sequential bytes in the internal RAM ... 11
4.1.6 nterrogation of a partition of external memories ... 12
4.1.7 Setting or changing analogue value ... 13
4.1.8 Changing over operating mode ... 14
4.1.9 Changing a word in the serial EEPROM ... 15
4.1.10 Changing up to four addressable bytes in the internal RAM ... 16

5 Testing possibilities ... 17
5.1 Electrical connections between computer and Bitric P ... 17
5.2 Data traffic ... 17

Appendix

Memory addresses in the Bitric P ... 18

Important instructions! Please read and observe!

Correct and safe operation of the Bitric P calls for appropriate transportation and storage, expert installation and commissioning as well as correct operation and meticulous maintenance.

Only those persons conversant with the installation, commissioning, operation and maintenance of similar apparatuses and who possess the necessary qualifications are allowed to work on the Bitric P.

Please take note of
- the contents of this Operating Manual,
- the safety regulations affixed to the Bitric P and
- the safety regulations pertaining to the installation and operation of electrical systems.

The directives, norms and guidelines mentioned in this Operation Manual are applicable in the Federal Republic of Germany. When using the Bitric P in other countries, please observe the national regulations prevailing in the respective country.

The Bitric P has been designed and tested in accordance with EN 61 010-1 = DIN VDE 0411 Part 1 "Protective measures for electronic measuring instruments" and has been supplied in a safe condition. In order to retain this condition and to ensure safe operation, the safety instructions in this Operating Manual bearing the headline "Caution" must be observed. Otherwise, persons can be endangered and the apparatus itself as well as other equipment and facilities can be damaged.

If the information in this Operating Manual should prove to be insufficient in any point, the ABB Service Department will be delighted to give you more information.

1 Description

Serial communication via an add-on RS-485 interface converter is based on the Standard DIN 19245 Part 1.

However, only part of the stipulations in this standard have been followed.

Amongst other things, all those relating to multi-master operation have been omitted because the Bitric P controller always operates as slave on the bus.

Communication via an RS-232 C interface is also possible using a special interface converter.

2 Data transfer

A combination of telegram characters is combined into one or several telegrams for the data transmission. These telegrams also perform the "handshake" function in that each telegram from the computer to the controller must first be replied to before a further telegram can be transmitted. Corresponding monitoring procedures are necessary in the computer in order to exclude non-replying controllers (timeout monitoring).

Standard transmission speeds (baud rates) must be set in the computer in preparation for the telegram traffic. It is also necessary to set an individual address in each controller (see Section 2.2).

2.1 Telegram characters (UART character or frame)

Note
The expression "frame" is used in the sections below. The frame character presentation is based on the ISO 1177 and 2022 standards (corresponding to DIN 66022 and CCITT 2.4).

Each frame consists of 11 bits:
1 start bit (ST) with logical "0" signal
8 information bits
1 even parity bit "P" with logical "0" or "1" signal
1 stop bit (SP) with logical "1" signal

0	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	1
ST	Daten									SP

With even parity, the number of "1s" in the frame is brought to an even value.

2.2 Permitted addresses

RS-485

All values 01H...7FH (H = hexadecimal) are permitted as destination and source addresses of the active subscribers (computers). All addresses from 00H...7FH; 81H...FCH, FEH and FFH are permitted for passive subscribers (controllers).

The allocation is arbitrary, although no address may be used more than once.

These telegrams are understood by all controllers, but not acknowledged. Global address is 80H.

Telegrams can only run via the address F0H in any communication via the RS- 232C interface.

3 Outline specification

3.1 Telegram formats

Only the following telegram types are used in the telegram format to DIN 19245:

Call and acknowledgement telegram with fixed information field length without data (DIN 19245, Section 4.6.1)

SD1/DA/SA/FC/FCS/ED
<-----L------>
SD1 = Start byte (start delimiter), code: 10H
DA = Destination address
SA = Source address
FC = Control byte (frame control)
FCS = Check byte (frame check sequence)
= sum of the hexadecimal values of the L frames above 255 without carry-over
ED = End byte (end delimiter), code: 16H
L = Length
= number of bytes in FCS (L = 3).

Call and acknowledgement telegram with fixed information field length with data (DIN 19245, Section 4.6.2)

SD3/DA/SA/FC//<---8 data bytes--->/FCS/ED
<----------L---------->
SD3 = Start byte (start delimiter), code: 2AH
DA = Destination address
SA = Source address
FC = Control byte (frame control)
FCS = Check byte (frame check sequence)
= sum of the hexadecimal values of the L frames above 255 without carry-over
ED = End byte (end delimiter), code: 16H
L = Length
= number of bytes in FCS (11 = 0BH).

Data telegram with variable information field length containing data (DIN 19245, Section 4.6.3)

SD2/LE/LEr/SD2/DA/SA/FC/<---n frames-->/FCS/ED
<----------L---------->
SD2 = Start byte (start delimiter), code: 68H
LE = L, number of frames minus 6
LEr = Repetition of LE
DA = Destination address
SA = Source address
FC = Control byte (frame control)
FCS = Check byte (frame check sequence) sum of the hexadecimal values of the L frames without carry-over above 255
ED = End byte (end delimiter), code 16H
L = Length
= number of bytes in FCS (11 = 0BH)

Only call and data telegrams with fixed information length are transmitted from computer to computer. The controllers respond with acknowledgement telegrams or data telegrams of variable information field length.

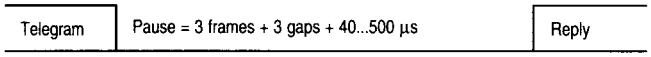
3.2 Transmission rules

The idle state of the line corresponds to the logical "1" signal.

Before data transmission begins - starting from the computer - a minimum time of 33 bit (sync. time) is required as idle condition for synchronisation.

Pauses of length < 0.3 " frame length are permitted between the frames of a telegram. Pauses of longer than 0.3 s are interpreted as "end of telegram" at all baud rates.

Between the reception of the last stop bit and the transmission of the first start bit, the controllers insert a pause of three frames for synchronisation. A processing time of 40...500 µs for the telegram setup is added to this. The gap between two frames is about 40 µs.



The controller checks:
per frame start bit, stop bit and parity bit
per telegram start byte, DA byte, SA byte, FCS byte and end byte.

If these checks produce a negative result, the entire telegram is rejected as erroneous. A similar check should be performed in the computer.

In the reply, the controllers adopt the source address of the computer telegram as destination address for the reply, and set their own address as source address.

Important note
It must be ensured in the user programme that the receiving equipment in the RS-485 interface in the computer (or in a separate interface converter) is switched off (disabled) during the transmission, so that it does not listen to its own telegrams.

3.3 Calculating the checksum FCS

The length L is always the number of bytes from "DA" up to a position in front of "FCS".

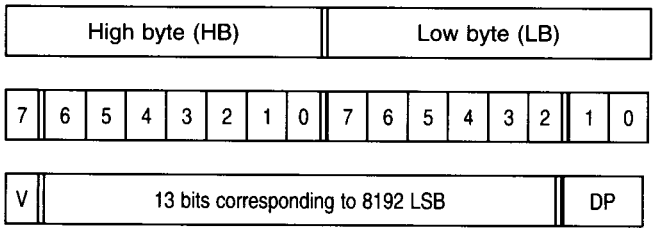
These bytes are added up and transferred into the telegrams (without carry-over) as "FCS".

Calculating FCS (example)

DA = 6EH, SA = 66H, FC = 01H
E6H + 66H + 01H = 14DH
FCS = 4DH

3.4 Calculating values

In the controllers, all values in the numerical range -7996..+7996 are stored in 2 bytes. This means that the numerical range is normally displayed correspondingly as -199.9...+199.9. The values of bits 2 and 3 are rounded off in this conversion.



V = Sign: positive: V = 1
DP = Decimal point position

Bit 1	Bit 2	Decimal point position
0	0	XXX.X
0	1	XX.XX
1	0	X.XXX
1	1	XXXX

These uniformly stored values are interpreted differently in the controllers. A distinction is drawn between three main groups:

1. Values which are displayed in the user range (the right-hand decimal point in the display flashes).

   The stored value for the display is automatically brought into the format stipulated by the user-range definition. The decimal point position is stipulated by the user-range definition in the controller. The information for the decimal point position stored in the low byte is suppressed.

   Agreeing user-range definitions must be set in both the controller and the computer.

2. PID parameters (Xp,Tn,Tn)

   In the case of PID parameters, negative values are interpreted as the value zero. The decimal point position is fixed in the proportional range: with the derivative and integral action times, it is defined in the low byte of TN by the configuration.

   with TN and Td,
   1234 means 1234 seconds and
   123.4 means 123.4 minutes.

   An entry mask with a decimal point position in agreement with the controller must be defined in the computer for the entry of parameter values.

3. Other values

   The information stored in the high and low bytes is displayed unchanged, including the decimal point position.

   An entry mask with a decimal point position in agreement with the controller must be defined in the computer for the entry of values. The definition must always be transmitted in bits 0 and 1.

The following rules apply to data transfer via the interface:

- Only standardised values are transferred via the interface. Data, which are displayed in the computer in physical units (user range) must first be standardised before transfer to the controller.
- If a mantissa which differs from the definition is entered at the computer, the value must be adapted by rounding.

Examples:

User range = 300.0...600.0 in controller and computer
Task: to transmit 450.534 to the controller

$$A = \frac{450.543 - 300.0}{600.0 - 300.0} \cdot 100 = 50.181\% \qquad (1)$$

rounding:

$$B = \text{int}([A \cdot 40] + 0.5) \cdot 4 + 32768 \qquad (2)$$
$$B = 40796$$

converting the integer part of B into a hexadecimal number:

C = Hex(B) = 9F5CH corresponds to 50.175% (3)

The value of C is transmitted in the telegram as HB = 9F and LB = 5C.

Rule

The decimal point position should first be read out from the controller before programme start and then transferred into the values which are to be transmitted to the controller.

A change should only be made if - for example - the time range of the integral action time has to be converted from seconds into minutes.

4 Telegrams

4.1 Telegrams for the operation

4.1.1 Presence interrogation

These telegrams are used to check the presence and functional capabilities of the connected controllers.

Interrogation:

Computer to Bitric P

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Control byte FC = 01H
5	Check byte FCS (from 2 to 4)
6	End byte ED = 16H

Reply, provided destination address is not the same as global address:

Bitric P to computer

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Acknowledgement code
5	Check byte FCS (from 2 to 4)
6	End byte = 16H

Acknowledgement code: 10H = positive, ie device can be reached, 11H = negative, ie device cannot be reached.

A repeat request (function code 12H) is not provided.

4.1.2 Standard interrogation, binary signals

This telegram is used for the interrogation of important binary variables.

Interrogation:

Computer to Bitric P

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Control byte FC = 01H
5	Check byte FCS (from 2 to 4)
6	End byte ED = 16H

Reply, provided destination address is not the same as global address:

Bitric P to computer

1	Start byte SD2 = 68H
2	Length = 0DH
3	Length = 0DH
4	Start byte SD2 = 68H
5	Destination address DA
6	Source address SA
7	Control byte FC = 02H
8	Byte 1
9	Byte 2
10	Check byte FCS (5...9)
11	End byte = 16H

Meaning of bits in the reply byte

Byte 1

7	Erroneous input measurement
6	
5	
4	
3	Writing and reading error EEPROM
2	Error in self parameterisation
1	EPROM has checksum error
0	Waiting queue for EEPROM full

Byte 2

7	8 s long after reset
6	Relay 1 energised
5	Relay 2 energised
4	
3	Automatic
2	
1	
0	Manual

4.1.3 Standard interrogation of analogue and bina-ry values

This telegram is used for interrogating the binary values listed in Section 4.1.2 and the analogue values defined here.

Interrogation:

Computer to Bitric P

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Control byte FC = 01H
5	Check byte FCS (from 2 to 4)
6	End byte ED = 16H

Reply, provided destination address is not same as global address:

Bitric P to computer

1	Start byte SD2 = 68H
2	Length
3	Length
4	Start byte SD2 = 68H
5	Destination address DA
6	Source address SA
7	Control byte FC = 03H
8	Byte 1 (see 4.1.2)
9	Byte 2 (see 4.1.2)
10	X_H
11	X_L
12	W_H
13	W_L
14	XW_H
15	XW_L
16	Y_H
17	Y_L
18	G1_H
19	G1_L
20	G2_H
21	G2_L
22	G3_H
23	G3_L
...	Check byte FCS (5 to 23)
...	End byte = 16H

Analogue values are always contained in two sequential bytes,
e.g. X_H: controlled variable high byte
X_L: controlled variable low byte

4.1.4 Interrogation of up to eight addressable analogue values

Interrogation:

Computer to Bitric P

1	Start byte SD3 = A2H
2	Destination address DA
3	Source address SA
4	Control byte FC = 04H
5	Value list address 1
6	Value list address 2
7	Value list address 3
8	Value list address 4
9	Value list address 5
10	Value list address 6
11	Value list address 7
12	Value list address 8
13	Check byte FCS (2 to 12)
14	End byte ED = 16H

Reply, provided destination address is not same as global address:
Bitric P to computer

1	Start byte SD2 = 68H
2	Length
3	Length
4	Start byte SD2 = 68H
5	Destination address DA
6	Source address SA
7	Control byte FC = 04H
8	Value 1 high byte
9	Value 1 low byte
10	Value 2 high byte
11	Value 1 low byte
	...
22	Value 8 high byte
23	Value 8 low byte
24	Check byte FCS (from 5 to 23)
25	End byte = 16H

If two identical addresses are entered immediately after one another at any point in the interrogation telegram, the subsequent addresses are ignored. The reply then contains the values up to the twice-occurring address and is correspondingly shorter.

FCS is always calculated from Position 5 up to the last value carried over. "Length" always shows the number of bytes invoked for the calculation of the checksum.

The transmitted data are calculated back according to the pattern below:

Example

Transmitted:
HB = CDH; LB = 21H produces the value CD21H

Value without decimal point position:
CD21 AND FFFC = CD20H

Corresponds to decimal:
52.512
-32.768

19.744

Calculated value:
19.744: 160 = 123.4%

Decimal point position:
CD21H AND 03H = 01

Produces positive value 12.34 in the display.

4.1.5 Interrogation of up to eight sequential bytes in the internal RAM

Interrogation:

Computer to Bitric P

1	Start byte SD3 = A2H
2	Destination address DA
3	Source address SA
4	Control byte FC = 05H
5	Start address
6	1 < number < 8
7	No significance
8	No significance
9	No significance
10	No significance
11	No significance
12	No significance
13	Check byte FCS (from 2 to 12)
14	End byte ED = 16H

Reply, provided destination address is not the same as global address:
Bitric P to computer

1	Start byte SD2 = 68H
2	Length
3	Length
4	Start byte SD2 = 68H
5	Destination address DA
6	Source address SA
7	Control byte FC = 05H
8	Byte 1
9	Byte 2
10	Byte 3
11	Byte 4
12	Byte 5
13	Byte 6
14	Byte 7
15	Byte 8
16	Check byte FCS (from 5 to 15)
17	End byte = 16H

The reply always contains the byte from the start address at Position 8, even if "0" has been specified as number. The number of bytes after this and thus the total length of the reply telegram always corresponds to the value of "number".

FCS is always calculated from Position 5 up to the last byte determined by "number".

"Length" always indicates the number of bytes enlisted for the calculation of the checksum.

4.1.6 Interrogation of a partition of external memories

Interrogation:
Computer to Bitric P

1	Start byte SD3 = A2H
2	Destination address DA
3	Source address SA
4	Control byte FC = 06H
5	Address high byte
6	Address low byte
7	1 < number < 10
8	C
9	No significance
10	No significance
11	No significance
12	No significance
13	Checkbyte FCS (from 2 to 12)
14	End byte ED = 16H

For C = 00, a word is always fetched from the serial EEPROM. "Number" is without significance: only a word is sent in every case.

For C > 00, as many bytes are fetched for the EEPROM as are specified by "number". The maximum number is 10. Greater values are limited to 10.

Reply, provided not the same as global address:

For C = 00
Bitric P to computer

1	Start byte SD2 = 68H
2	Length
3	Length
4	Start byte SD2 = 68H
5	Destination address DA
6	Source address SA
7	Control byte FC = 06H
8	Word high byte
9	Word low byte
10	Check byte FCS (from 5 to 9)
11	11 End byte ED = 16H

For C > 00
Bitric P to computer

1	Start byte SD2 = 68H
2	Length
3	Length
4	Start byte SD2 = 68H
5	Destination address DA
6	Source address SA
7	Control byte FC = 06H
8	Byte 1
9	Byte 2
10	Byte 3
	...
17	Byte 10
18	Check byte FCS (from 5 to 17)
19	End byte EC = 16H

With C = 00, a negative acknowledgement (see above) can be given as reply if the entered address is >3FH, or if a collision occurs with a read access to the EEPROM just running in the Bitric P.

FCS is always calculated from Position 5 up to the last byte determined by "number".

"Length" always indicates the number of bytes enlisted for the calculation of the checksum.

4.1.7 Setting or changing analogue value

Interrogation:

Computer to Bitric P

1	Start byte SD3 = A2H
2	Destination address DA
3	Source address SA
4	Control byte FC = 07H
5	C
6	Address
7	Data item high byte
8	Data item low byte
9	No significance
10	No significance
11	No significance
12	No significance
13	Check byte FCS (from 2 to 12)
14	End byte ED = 16H

Reply, provided not the same as global address:
Bitric P to computer

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Acknowledgement code
5	Check byte FCS (from 2 to 4)
6	End byte ED = 16H

C = 00, 03, 04: no action

C = 01 File data item at specified address (set)
C = 02 Add data item to the content of the specified address with correct sign and store at the address (change)
C = 05 As C = 01, but additionally bring value into background memory in EEPROM (not Y_H)
C = 06 As C = 02, but additionally bring value into background memory in EEPROM (not Y_H)
C > 07 Negative acknowledgement

The high bytes of the analogue value addresses W_H ... TO2_H and Y_H are permitted as addresses. Receipt is confirmed with positive acknowledgement.

Other addresses and the low bytes of the analogue value addresses are replied to with a negative acknowledgement.

Negative acknowledgement is also transmitted if Y_H is addressed in automatic operating mode, and if Y_H is addressed with C = 01 with the three-position step action controller or positioner.

With C = 05 or 06, it must be ensured that each telegram (other than with Y_H) initiates a write action in the EEPROM. Because each register in the EEPROM only has a guaranteed life of 10,000 write cycles, it is therefore necessary to avoid too frequent value changes (e.g. for set point management by the PC).

4.1.8 Changing over operating mode

Interrogation:

Computer to Bitric P

1	Start byte SD3 = A2H
2	Destination address DA
3	Source address SA
4	Control byte FC = 08H
5	Data item
6	No significance
7	No significance
8	No significance
9	No significance
10	No significance
11	No significance
12	No significance
13	Check byte FCS (from 2 to 12)
14	End byte ED = 16H

Reply, provided not global address:

Bitric P to computer

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Acknowledgement code
5	Check byte FCS (from 2 to 4)
6	End byte ED = 16H

Value of "data item":

Setting of operating mode "manual" x1H
Setting of operating mode "automatic" x4H
(x: No significance)
All values are replied to with a negative acknowledgement.

Negative acknowledgement is also performed when trying to set "manual" if only "automatic" has been enabled according to the configuration, or vice versa.

4.1.9 Changing of value in the serial EEPROM

Interrogation:

Computer to Bitric P

1	Start byte SD3 = A2H
2	Destination address DA
3	Source address SA
4	Control byte FC = 0EH
5	Address
6	Word high byte
7	Word low byte
8	No significance
9	No significance
10	No significance
11	No significance
12	No significance
13	Check byte FCS (from 2 to 12)
14	End byte ED = 16H

Reply, provided not global address:
Bitric P to computer

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Acknowledgement code
5	Check byte FCS (from 2 to 4)
6	End byte ED = 16H

Negative acknowledgement is transmitted if address is > 3FH or if it is attempted to write too quickly in succession (telegram interval > 30 ms) into the EEPROM.

4.1.10 Changing up to four addressable bytes in the internal RAM

Interrogation:

Computer to Bitric P

1	Start byte SD3 = A2H
2	Destination address DA
3	Source address SA
4	Control byte FC = 0FH
5	Address 1
6	Data item 1
7	Address 2
8	Data item 2
9	Address 3
10	Data item 3
11	Address 4
12	Data item 4
13	Check byte FCS (from 2 to 12)
14	End byte ED = 16H

Reply, provided not global address:
Bitric P to computer

1	Start byte SD1 = 10H
2	Destination address DA
3	Source address SA
4	Acknowledgement code
5	Check byte FCS (from 2 to 4)
6	End byte ED = 16H

Changes are not performed in value-critical address ranges, used only for internal purposes. This concerns the following ranges:

00H...0FH
PHDK...BUFE2
WSEEP_STATUS...FFH

Negative acknowledgement is returned if only addresses are entered in these ranges.

5 Testing possibilities

It can happen that communication between a computer and Bitric P devices does not function immediately because of faults attributable to various causes.

The notes below are useful in locating and clearing the cause of fault. Unless expressly mentioned otherwise, they relate to the use of the RS-485 interface connections.

For easier fault location, it is recommended that unproven communications hardware and software are first tested using a single controller.

5.1 Electrical connections between computer and Bitric P

When a telegram is being sent by the computer, it is possible to observe a pulse packet between Lines A and B with an oscilloscope. The duration of this depends on the transmission speed (baud rate).

This is 65,600/baud rate (ms) for the telegram "presence interrogation" (function code 01). With correct data traffic, the positive acknowledgement then follows at an interval of 40,000/baud rate (ms) with a duration of 65,600/baud rate (ms).

5.2 Data traffic

The contents of specific registers in the Bitric P can be enlisted for checking the data traffic between computer and Bitric P controller.

Procedure:

1. Using the monitor function of the Bitric P "dCEL", select "r" (flashing), set the content of Address 57 to "00" (if necessary also that of Addresses 58..5DH).
2. Transmit telegram "presence interrogation" (function code 01) to the Bitric P.
3. Check contents of Addresses 57H...5DH.

With correct reception and subsequent reply, it must be possible to call the following data:

Address 57H	5DH
Address 58H	10H
Address 59H	Master address (destination address)
Address 5AH	Bus address (source address)
Address 5BH	10H (positive acknowledgement)
Address 5CH	Checksum (sum of the data in Addresses 59H...5BH)
Address 5DH	16H

Possible faults:

00 in Address 57H remains unchanged (no reception)
- electrical connection faulty between computer and Bitric P
- hardware fault in the controller
- different baud rates set in the computer and controller
- incorrect frame format
- time condition for the frame intervals not satisfied

5FH in Address 57H
- wrong bus address
- checksum in telegram wrong

Appendix

Memory addresses in the Bitric P

Binary variable

	0	Manual (becomes effective in the controller after about 2 s)
	1	
	2	Automatic (becomes effective in the controller after about 2 s)
	3	
26	4	Manual (becomes effective immediately in the controller)
	5	
	6	Automatic (becomes effective immediately in the controller)
	7	

Analogue variables

Byte	Name	Function
68	ERR	General byte for error messages
69	Baud	Baud rate
6A	PAdr	Address
6B	W	Setpoint
6D	WL	Setpoint, minimum limiting
6F	WH	Setpoint, maximum limiting
71	G1	Alarm value 1
73	G2	Alarm value 2
75	G3	Alarm value 3
77	XP	Proportional range
79	TN	Integral action time
7B	TV	Derivative action time
7D	Y0	Operating point, dead zone with step controller
7F	T0	Minimum switch-on time with switching controllers
81	YL	Controller output, minimum limiting
83	YH	Controller output, maximum limiting
85	K1	Multiplier, Input 1
87	K2	Multiplier, Input 2
89	C1	Addition to Input 1
8B	C2	Addition to Input 2
8D	XP2	Proportional range, cooling
8F	TN2	Integral action time, cooling
91	TV2	Derivative action time, cooling
93	T02	Minimum switch-on time, Output 2
99	USRA_H	Input 1: User range start
9A	USRA_L	Input 1: User range start
9B	USRU_H	Input 1: User range extent
9C	USRU_L	Input 1: User range extent
9D	USRDP	Input 1: User range
CC	X	Weighted Input 1
CE	A	Weighted Input 2
D0	XW	Control deviation
D2	Y	Controller output
D4	HILFSGR	Terminal temperature (reference junction)
D6	EIN1	Unweighted Input 1
D8	EIN2	Unweighted Input 2

Subject to technical changes.

ABB Automation Products GmbH
Höseler Platz 2
D-42579 Heiligenhaus
Phone +49 (0)20 56) 12 - 51 81
Fax +49 (0)20 56) 12 - 50 81
http://www.abb.com

Subject to technical changes.
Printed in the Fed. Rep. of Germany
42/61-42 EN Rev. 051
Edition 07.01