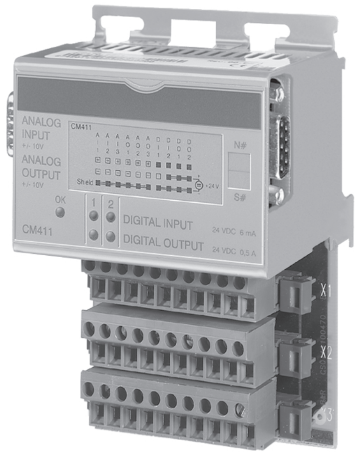
13.5 CM411

13.5.1 Technical Data



Terminal block is not included in the delivery.

Module ID	**CM411**
General Information	
Model Number	7CM411.70-1
Short Description	2003 Combination Module, 3 inputs, 24 VDC, 50 kHz, sink, one-channel or two-channel counters, incremental encoders, 2 transistor outputs, 24 VDC, 0.5 A, comparator function, short-circuit protection, 3 inputs, +/- 10 V, 16 Bit, 3 outputs, +/- 10 V, 16 Bit, Order terminal blocks separately!
C-UL-US Listed	in preparation
B&R ID Code	$C2
Module Type	B&R 2003 I/O Module
Amount [1)] CP430, EX270 CP470, CP770 CP474, CP476, CP774 EX470, EX770 EX477, EX777	 1 2
Voltage and Output Monitoring	Yes (LED: OK) Supply voltage >18 V, Outputs OK
Electrical Isolation Analog - PCC Digital - PCC Digital - Analog	 No Yes Yes
Power Consumption	Max. 2.4 W
Analog Inputs	
Number of Inputs	3
Input Signal - Nominal	±10 V
Digital Converter Resolution	16 Bit

Module ID	CM411
Data Format Delivered to Application Program	16 Bit 2s complement
Value Range +10 V -10 V	 $7FFF $8001
Measurement Range Monitoring Open Inputs Range Exceeded (neg.) Range Exceeded (pos.) General Error	 $7FFF $8001 $7FFF $8000
Maximum Error at 25 °C	±0.1 % 2)
Offset Drift	±0.3 LSB / °C 2)
Gain Drift	±65 ppm / °C 3)
Maximum Error over Entire Temperature Range	±0.25 % 2)
Repeat Precision	±0.025 % 2)
Input Impedance in Signal Range	≥1 MΩ
Analog Outputs	
Number of Outputs	3
Output Signal	±10 V
Load	Max. ±10 mA
Digital Converter Resolution	16 Bit
Maximum Error at 25 °C	±0.1 % 2)
Offset Drift	±2.5 LSB / °C 2)
Gain Drift	±110 ppm / °C 3)
Maximum Error over Entire Temperature Range	±0.25 % 2)
Load Impedance	≥1 kΩ
Short Circuit Current	±15 mA (individual sustained short-circuit protection)
Digital inputs	
Number of Inputs	3 counter inputs
Wiring	Sink
Input Voltage Minimum Nominal Maximum	 18 VDC 24 VDC 30 VDC
Switching Threshold LOW Range HIGH Range	 <5 V >15 V
Input Delay	Max. 3 µs
Input Current at Nominal Voltage	Approx. 6 mA
Incremental Encoder Operation Signal Form Evaluation Input Frequency Counter Frequency Count Size Input 1 Input 2 Input 3	 Square wave pulses 4-fold, cyclic counter 50 kHz 200 kHz 32 Bit Channel A Channel B Ref

Module ID	CM411
Event Counter Operation Signal Form Evaluation Input Frequency Counter Frequency Count Size Input 1 Input 2	 Square wave pulses Each edge, cyclic counter 50 kHz 100 kHz 2 x 16 Bit Counter 1 Counter 2
Comparator Evaluation Comparator Output Reaction Time	 Actual value comparison of the counter value during incremental encoder operation or of counter 2 during event counter operation (window comparator) Output 1 $<100\mu s$
Electrical Isolation Input - Input	 No
Digital Outputs	
Number and type of outputs	2 transistor outputs
Rated Current	Max. 0.5 A
Total Output Current	Max. 1 A
Rated Voltage	24 VDC
Switching Voltage Range	18 -30 VDC
Wiring	Source
Short Circuit Protection	Yes
Overload Protection	Yes
Negative Anode Potential when Switching Off Inductive Loads	59 V
Switching Delay log 0 - log 1 log 1 - log 0	 Max. 100 μs Max. 100 μs
Electrical Isolation Output - Output	 No
Mechanical Characteristics	
Dimensions	B&R 2003 single width

[1] Two logical module slots are required by the module.

[2] Referring the measurement range.

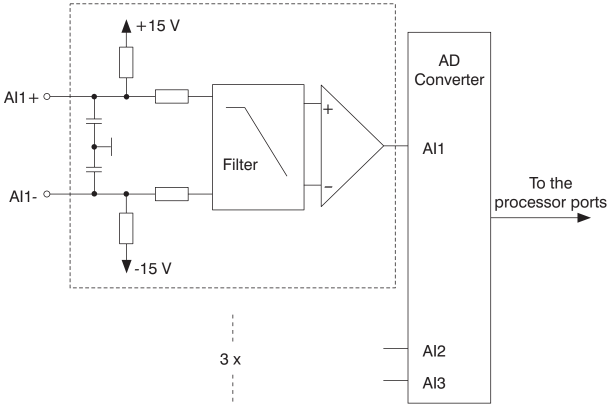
[3] Referring the current measurement value.

13.5.2 Status LEDs

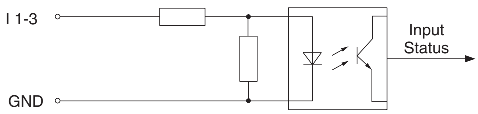
LED	Description
OK	This orange LED is lit when the external supply voltage for the outputs is within the defined range (>18 VDC).
LED 1 -2, green	Logical status of the respective digital input.
LED 1 -2, orange	Control status of the respective digital output.

13.5.3 Input Circuit Diagram

Analog Inputs

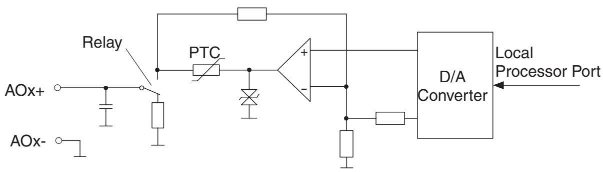


Digital inputs

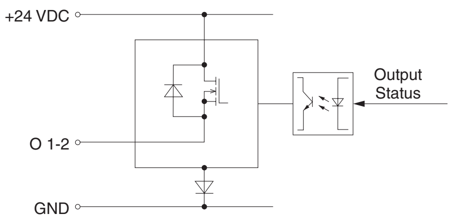


13.5.4 Output Circuit Diagram

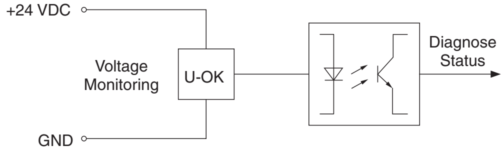
Analog Outputs



Digital Outputs



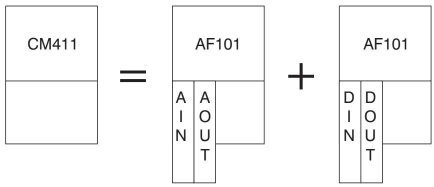
13.5.5 Supply Voltage Monitoring



13.5.6 Module Design

General Information

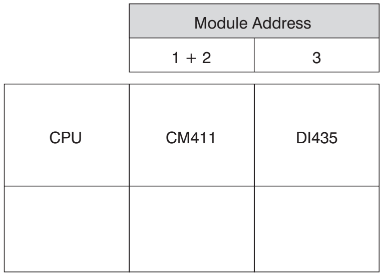
The design of the combination module CM411 corresponds to two AF101 adapter modules with two screw-in modules installed.



AIN ... Analog inputs
AOUT ... Analog outputs
DIN ... Digital inputs (counter inputs)
DOUT ... Digital outputs

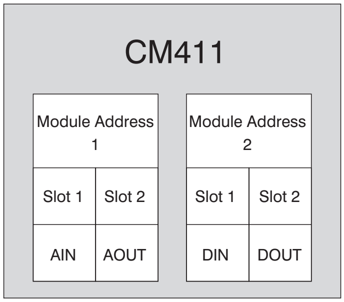
Module Addresses

Because of this special module design, the combination module CM411 requires two module addresses. A CPU, a combination module CM411 and a digital input module DI435 are used in the example shown below. The module address assignments are to be made as shown in the diagram.



Variable Declaration

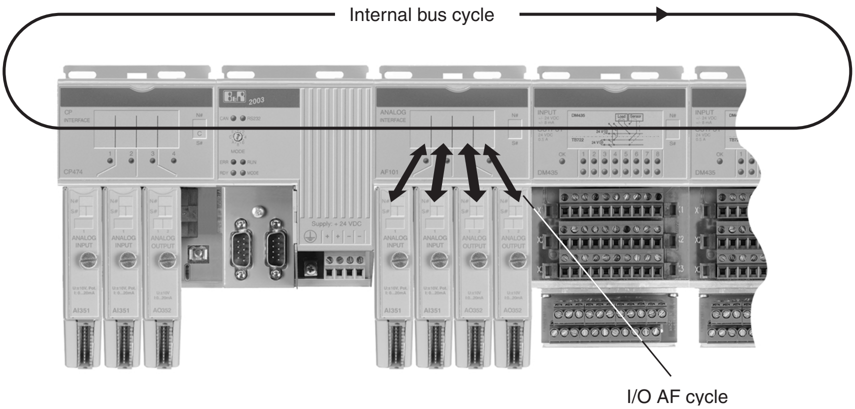
To avoid conflicts in the register, the settings listed below must be used in the variable declaration for the module address and for the slot.
In this case, the module is accessed with module addresses 1 and 2.



13.5.7 Timing

The following three factors must be taken into consideration for timing when a B&R 2003 CPU is used as controller:

- Internal Bus Cycle
- I/O AF Cycle
- I/O CPU Load



Internal Bus Cycle

All combination modules, AF modules and digital I/O modules are processed during this time. The internal bus cycle for a CM411 is calculated as follows:

<u>There is no AF101 adapter module on the bus</u>

$t_{int\_cycle} = n * 44\,\mu s * 6 + 6 * 120\,\mu s + 1200\,\mu s = 2184\,\mu s \quad (n = 1)$

n .... Number of CM411 modules
44 µs .... Time for a combination module CM411
6 .... Number of data words for a CM411
120 µs ...... Combination module CM411 busy
1200 µs .... Offset

<u>There is an AF101 adapter module on the bus or a CPx74 is used as CPU</u>

$t_{int\_cycle} = n * 44\,\mu s * 6 + 6 * 200\,\mu s + 1200\,\mu s = 2664\,\mu s \quad (n = 1)$

n .... Number of CM411 modules
44 µs .... Time for a combination module CM411
6 .... Number of data words for a CM411
200 µs ...... AF101 or CPx74 busy
1200 µs .... Offset

I/O-AF Cycle

During this time, all data points on the combination module CM411 are updated or read in internally.

$t_{IO\_AF} \leq 1\,ms$

I/O CPU Load

This time determines how long the CPU requires to process the I/O data passed on by the combination module CM411. The CPU is loaded considerably by the analog I/O data.

<u>A CP430 or CPx70 is used as CPU</u>

$t_{IO\_CPU} = 6 * 100\,\mu s = 600\,\mu s$

6 .... Number of data words for a CM411
100 µs ...... Analog data point on CP430 or CPx70

<u>A CPx74 is used as CPU</u>

$t_{IO\_CPU} = 6 * 70\,\mu s = 420\,\mu s$

6 .... Number of data words for a CM411
70 µs .... Analog data point on CPx74

<u>A CP476 is used as CPU</u>

$t_{IO\_CPU} = 6 * 50\,\mu s = 300\,\mu s$

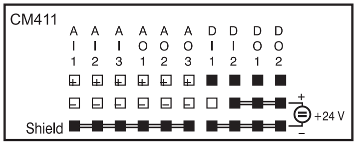
6 .... Number of data words for a CM411
50 µs .... Analog data point on CP476

Task Class

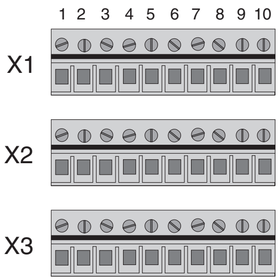
Fastest Task Class Recommended: 4 ms

13.5.8 Legend Sheets

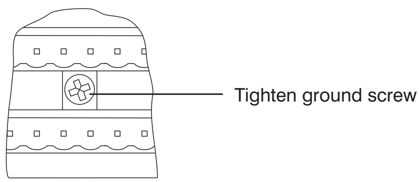
A legend sheet can be slid into the front of the module from above. The module circuit is shown on the back. The inputs/outputs can be labelled on the front.



13.5.9 Connections



TB710

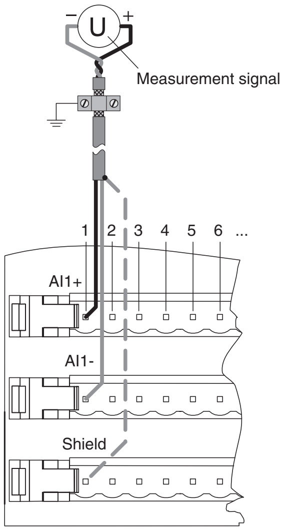


X1	
Analog Inputs	
1	+ Input AI1
2	+ Input AI2
3	+ Input AI3
Analog Outputs	
4	+ Output AO1
5	+ Output AO2
6	+ Output AO3
Digital Inputs	
7	Input DI1
8	Input DI2
Digital Outputs	
9	Output DO1
10	Output DO2

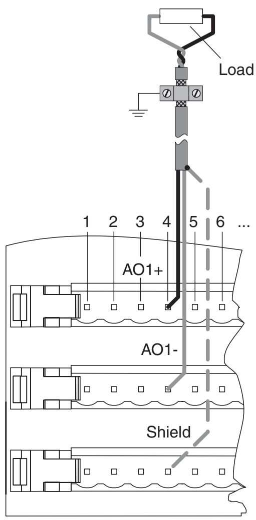
X2	
Analog Inputs	
1	- Input AI1
2	- Input AI2
3	- Input AI3
Analog Outputs	
4	Ground AO1-
5	Ground AO2-
6	Ground AO3-
Digital Inputs/Outputs	
7	DI3
8	+24 VDC
9	+24 VDC
10	+24 VDC

X3	
Analog Inputs / Outputs	
1	Shield
2	Shield
3	Shield
4	Shield
5	Shield
6	Shield
Digital Inputs / Outputs	
7	Ground
8	Ground
9	Ground
10	Ground

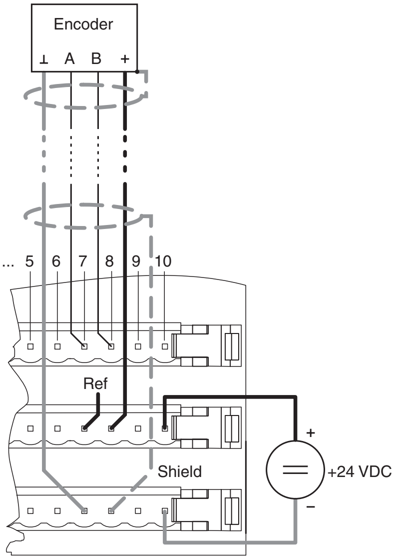
13.5.10 Connection Example Analog Inputs



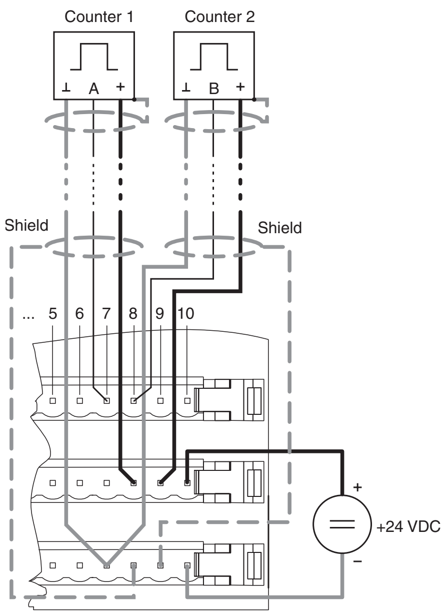
13.5.11 Connection Example Analog Outputs



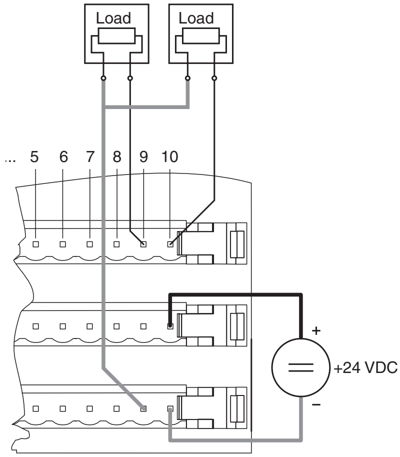
13.5.12 Connection Example Incremental Encoder Operation



13.5.13 Connection Example Event Counter Operation



13.5.14 Connection Example Digital Outputs



13.5.15 Variable Declaration for the Analog Inputs

The variable declaration is valid for the following controllers:

- 2003 PCC CPU
- Remote I/O Bus Controller
- CAN Bus Controller

The variable declaration is made in PG2000. The variable declaration is described in Chapter 4, "Module Addressing".

Automation Studio™ Support: See Automation Studio™ Help starting with V 1.40

Accessing screw-in modules is also explained in the sections "AF101" and "CPU".

Data access takes place using data and configuration words. The following table provides an overview of which data and configuration words are used for the analog inputs.

Data Access	VD Data Type	VD Module Type	VD Chan.	R	W	Description
Data word 0	INT16	Analog In	1	●		Analog input value channel 1
Data word 1	INT16	Analog In	2	●		Analog input value channel 2
Data word 2	INT16	Analog In	3	●		Analog input value channel 3
Configuration word 12	WORD	Transp. In	24	●		Module status
Configuration word 14	WORD	Transp. IN	28	●		Module type

Access using CAN Identifiers

Access via CAN Identifiers is used if the slave is being controlled by a device from another manufacturer. Access via CAN Identifiers is described in an example in Chapter 4, "Module Addressing". The transfer modes are explained in Chapter 5, "CAN Bus Controller Functions".

In the example below, the combination module CM411 is accessed with module addresses 1 and 2.

Analog input data cannot be packed. Only the first object from this group of four will be created and sent.

Slot	CAN ID [1)]	Word 1		Word 2		Word 3		Word 4
1	542	Chan. 1L	Chan. 1H	Chan. 2L	Chan. 2H	Chan. 3L	Chan. 3H	Not used
2	543	Not used						
3	544	Not used						
4	545	Not used						

[1)] CAN ID = 542 + (nd - 1) x 16 + (ma - 1) x 4 + (sl - 1)

nd ..... Node number of the CAN slave = 1

ma .... Module address = 1

sl .... Slot number = 1

B&R 2000 users have to exchange the data so that the high data is first (Motorola format)!

For more information on ID allocation, see Chapter 5, "CAN Bus Controller Functions".

Description of Data and Configuration Words

Data word 0, 1, 2 (read)

16 bit standardized voltage value.

Configuration Word 12 (read)

Configuration word 12 contains the module status.

Bit	Description
12 - 15	x .... Not defined, masked out
11	0 .... Converter values ready 1 .... Converter values not yet ready
3 - 10	x .... Not defined, masked out
2	0 .... Channel 3: No error 1 .... Channel 3: Error present
1	0 .... Channel 2: No error 1 .... Channel 2: Error present
0	0 .... Channel 1: No error 1 .... Channel 1: Error present

15							8	7							0
x	x	x	x		x	x	x	x	x	x	x	x			

Configuration Word 14 (read)

The High Byte of configuration word 14 defines the module code.

Bit	Description
8 - 15	Module code = $32
0 - 7	x ....Not defined, masked out

0	0	1	1	0	0	1	0	x	x	x	x	x	x	x	x
15							8	7							0

13.5.16 Variable Declaration for the Analog Outputs

The variable declaration is valid for the following controllers:

- 2003 PCC CPU
- Remote I/O Bus Controller
- CAN Bus Controller

The variable declaration is made in PG2000. The variable declaration is described in Chapter 4, "Module Addressing".

Automation Studio™ Support: See Automation Studio™ Help starting with V 1.40

Accessing screw-in modules is also explained in the sections "AF101" and "CPU".

Data access takes place using data and configuration words. The following table provides an overview of which data and configuration words are used for the analog outputs.

Data Access	VD Data Type	VD Module Type	VD Chan.	R	W	Description
Data word 0	INT16	Analog Out	1		●	Analog output value channel 1
Data word 1	INT16	Analog Out	2		●	Analog output value channel 2
Data word 2	INT16	Analog Out	3		●	Analog output value channel 3
Configuration word 14	WORD	Transp. In	28	●		Module type

Access using CAN Identifiers

Access via CAN Identifiers is used if the slave is being controlled by a device from another manufacturer. Access via CAN Identifiers is described in an example in Chapter 4, "Module Addressing". The transfer modes are explained in Chapter 5, "CAN Bus Controller Functions".

In the example below, the combination module CM411 is accessed with module addresses 1 and 2.

Analog output data cannot be packed. Only the second object from this group of four will be created.

Slot	CAN ID [1)]	Word 1		Word 2		Word 3		Word 4
1	1054	Not used						
2	1055	Chan. 1L	Chan. 1H	Chan. 2L	Chan. 2H	Chan. 3L	Chan. 3H	Not used
3	1056	Not used						
4	1057	Not used						

[1)] CAN ID = 1054 + (nd - 1) x 16 + (ma - 1) x 4 + (sl - 1)
nd ..... Node number of the CAN slave = 1
ma .... Module address = 1
sl .... Slot number = 2

B&R 2000 users have to exchange the data so that the high data is first (Motorola format)!

For more information on ID allocation, see Chapter 5, "CAN Bus Controller Functions".

Description of Data and Configuration Words

Data word 0, 1, 2 (write)

The 16 bit standardized values for voltage are written to the module output channel.

Configuration Word 14 (read)

The High Byte of configuration word 14 defines the module code.

Bit	Description
8 - 15	Module code = $34
0 - 7	x ....Not defined, masked out

0	0	1	1	0	1	0	0	x	x	x	x	x	x	x	x
15							8	7							0

13.5.17 Variable Declaration for Incremental Encoder Operation

The variable declaration is valid for the following controllers:

- 2003 PCC CPU
- Remote I/O Bus Controller
- CAN Bus Controller

The variable declaration is made in PG2000. The variable declaration is described in Chapter 4, "Module Addressing".

Automation Studio™ Support: See Automation Studio™ Help starting with V 1.40

Accessing screw-in modules is also explained in the sections "AF101" and "CPU".

Incremental encoder operation with PCC 2003 CPU and remote slaves

Data access takes place using data and configuration words. The following table provides an overview of which data and configuration words are used for the digital inputs in incremental encoder operation.

Data Access	VD Data Type	VD Module Type	VD Chan.	R	W	Description
Data word 0	WORD	Transp. In	0	●		Module status
Data word 1	INT32	Transp. In	2	●		Counter value
Configuration word 4	INT32	Transp. Out	8		●	Threshold value 1
Configuration word 6	INT32	Transp. Out	12		●	Threshold value 2
Configuration word 12	WORD	Transp. In	24	●		Module status
Configuration word 14	WORD	Transp. In	28	●		Module type
	WORD	Transp. Out	28		●	Module configuration

Incremental Encoder Operation with CAN Slaves

Data access takes place using data and configuration words. The following table provides an overview of which data and configuration words are used for the digital inputs in incremental encoder operation.

Data Access	VD Data Type	VD Module Type	VD Chan.	R	W	Description
Data word 0	INT32	Transp. In	0	●		Counter value
Data word 2	WORD	Transp. In	4	●		Module status
Configuration word 4	INT32	Transp. Out	8		●	Threshold value 1
Configuration word 6	INT32	Transp. Out	12		●	Threshold value 2
Configuration word 12	WORD	Transp. In	24	●		Module status
Configuration word 14	WORD	Transp. In	28	●		Module type
	WORD	Transp. Out	28		●	Module configuration

B&R 2000 users have to exchange the two counter status words so that the high word is first (Motorola format)!

Access Using CAN IDs

Access via CAN Identifiers is used if the slave is being controlled by a device from another manufacturer. Access via CAN Identifiers is described in an example in Chapter 4, "Module Addressing".
The transfer modes are explained in Chapter 5, "CAN Bus Controller Functions".

In the example below, the combination module CM411 is accessed with module addresses 1 and 2.

Digital input data cannot be packed. Only the first object from this group of four will be created and sent.

Slot	CAN ID [1)]	Word 1		Word 2		Word 3		Word 4
1	546	Count. LL	Count. ML	Count. MH	Count. HH	Status L	Status H	Not used
2	547	Not used						
3	548	Not used						
4	549	Not used						

[1)] CAN ID = 542 + (nd - 1) x 16 + (ma - 1) x 4 + (sl - 1)
nd ..... Node number of the CAN slave = 1
ma .... Module address = 2
sl .... Slot number = 1

B&R 2000 users have to exchange the data so that the high data is first (Motorola format)!

For more information on ID allocation, see Chapter 5, "CAN Bus Controller Functions".

Chapter 3
B&R 2003 Modules

Description of Data and Configuration Words

Data Word 0 (read)

Data word 0 includes the module status time constant for the counter value.

Bit	Description
8 - 15	x .... Not defined, masked out
7	0 .... Referencing is taking place 1 .... Counter is referenced (resetting takes place when the reference command is received)
6	Changes state each time referencing takes place
5	0 .... Supply voltage <18 V 1 .... Supply voltage >18 V, Outputs OK
4	Output status of the comparator
3	Level of encoder input A
2	Level of encoder input B
1	x .... Not defined, masked out
0	Level of the reference pulse

15							8	7							0
x	x	x	x	x	x	x	x							x	

Data Word 1 (read)

Counter Value MSW

Data Word 2 (read)

Counter Value LSW

Configuration Words 4+5 (write)

Threshold value 1 (32 Bit)

Number format: 32 bit with sign

Bit 10 in configuration word 14 (write) is set to 0.
Threshold value 1 must always be ≤ threshold value 2 .
Threshold values are internally arranged in increasing order including sign.

Number format: 32 bit without sign - cyclic operation

Bit 10 in configuration word 14 (write) is set to 1.
The threshold values are not placed in order internally. The sign is not used in the comparator calculation.

Configuration Words 6+7 (write)

Threshold value 2 (32 Bit)

Configuration Word 12 (read)

Configuration word 12 contains the module status (current status unlatched). The module status is written to data word 0.

Configuration Word 14 (read)

The High Byte of configuration word 14 defines the module code.

Bit	Description
8 - 15	Module code = $36
0 - 7	x .... Not defined, masked out

15							8	7							0
0	0	1	1	0	1	1	0	x	x	x	x	x	x	x	x

Configuration Word 14 (write)

The module is configured using configuration word 14.

Bit	Description
13 - 15	0
12	0 .... Incremental encoder operation
11	0 .... No effect on count direction 1 .... Count direction inverted as compared to counter wiring
10	0 .... Number format: 32 bit with sign 1 .... Number format: 32 bit without sign - cyclic operation In continuous operation, the internal order of the threshold values are kept. If a counter overflow occurs, the behavior of the comparator does not have to be changed. Comparator operation takes place without consideration of the sign.
8 - 9	0 .... Incremental encoder operation with 4-fold evaluation
7	0 .... No effect on reference pulse 1 .... Reference pulse is inverted. This setting is used for encoders with a high pulse.
6	0 .... Set counter immediately to 0. In data word 0 (module status), bit 7 is immediately set to 1 and the counter is cleared. 1 .... Counter remains functioning. In data word 0 (module status), bit 7 is immediately set to 0 (referencing required).
5	0
4	0 .... No effect on counter 1 .... Clear counter (reference)
3	0 .... Comparator off Output 1 is handled as defined in the variable declaration for digital outputs. 1 .... Comparator on
2	0 .... The comparator output is set to the level given in bit 0, if threshold value 1 ≤ counter ≤ threshold value 2 1 .... The comparator output is set to the inverted level of bit 0, if threshold value 1 ≤ counter ≤ threshold value 2
1	0
0	Level of the comparator output

15							8	7							0
0	0	0	0			0	0			0				0	

Chapter 3
B&R 2003 Modules

13.5.18 Variable Declaration for Event Counter Operation

The variable declaration is valid for the following controllers:

- 2003 PCC CPU
- Remote I/O Bus Controller
- CAN Bus Controller

The variable declaration is made in PG2000. The variable declaration is described in Chapter 4, "Module Addressing".

Automation Studio™ Support: See Automation Studio™ Help starting with V 1.40

Accessing screw-in modules is also explained in the sections "AF101" and "CPU".

Data access takes place using data and configuration words. The following table provides an overview of which data and configuration words are used for the digital inputs in event counter operation.

Data Access	VD Data Type	VD Module Type	VD Chan.	R	W	Description
Data word 0	WORD	Transp. In	0	●		Module status
Data word 1	WORD	Transp. In	2	●		Counter value of counter 1
Data word 2	WORD	Transp. In	4	●		Counter value of counter 2
Configuration word 5	WORD	Transp. Out	10		●	Threshold value 1 for counter 2
Configuration word 7	WORD	Transp. Out	14		●	Threshold value 2 for counter 2
Configuration word 14	WORD	Transp. In	28	●		Module type
	WORD	Transp. Out	28		●	Module configuration

Access using CAN Identifiers

Access via CAN Identifiers is used if the slave is being controlled by a device from another manufacturer. Access via CAN Identifiers is described in an example in Chapter 4, "Module Addressing". The transfer modes are explained in Chapter 5, "CAN Bus Controller Functions".

In the example below, the combination module CM411 is accessed with module addresses 1 and 2.

Digital input data cannot be packed. Only the first object from this group of four will be created and sent.

Slot	CAN ID [1)]	Word 1		Word 2		Word 3		Word 4
1	546	Count. 2L	Count. 2H	Count. 1L	Count. 1H	Status L	Status H	Not used
2	547	Not used						
3	548	Not used						
4	549	Not used						

[1)] CAN ID = 542 + (nd - 1) x 16 + (ma - 1) x 4 + (sl - 1)
nd ..... Node number of the CAN slave = 1
ma .... Module address = 2
sl .... Slot number = 1

B&R 2000 users have to exchange the data so that the high data is first (Motorola format)!

For more information on ID allocation, see Chapter 5, "CAN Bus Controller Functions".

Description of Data and Configuration Words

Data Word 0 (read)

Data word 0 includes the module status time constant for both counter values.

Bit	Description
6 - 15	x .... Not defined, masked out
5	0 .... Supply voltage <18 V 1 .... Supply voltage >18 V, Outputs OK
4	Output status of the comparator
3	Level of encoder input A: Counter 1
2	Level of encoder input B: Counter 2
0 - 1	x .... Not defined, masked out

15							8	7							0
x	x	x	x	x	x	x	x	x	x					x	x

Data Word 1 (read)

Counter value of counter 1.

Data Word 2 (read)

Counter value of counter 2.

Configuration Word 5 (write)

Threshold value 1 (16 Bit) for counter 2.

Number format: 16 bit without sign

Bit 10 in configuration word 14 (write) is set to 0.
Threshold value 1 must always be ≤ threshold value 2 .
Threshold values are internally arranged in increasing order. The sign is ignored.

Number format: 16 bit without sign - cyclic operation

Bit 10 in configuration word 14 (write) is set to 1.
The threshold values are not placed in order internally. The sign is ignored.

Configuration Word 7 (write)

Threshold value 2 (16 Bit) for counter 2.

Configuration Word 14 (read)

The High Byte of configuration word 14 defines the module code.

Bit	Description
8 - 15	Module code = $36
0 - 7	x .... Not defined, masked out

15							8	7							0
0	0	1	1	0	1	1	0	x	x	x	x	x	x	x	x

Configuration Word 14 (write)

The module is configured using configuration word 14.

Bit	Description
13 - 15	0
12	1 .... Event counter operation
11	0
10	0 .... Number format: 16 bit without sign 1 .... Number format: 16 bit without sign - cyclic operation In continuous operation, the internal order of the threshold values are kept. If a counter overflow occurs, the behavior of the comparator does not have to be changed.
9	0
8	0 .... Counter 1 and 2: Only count positive edges 1 .... Counter 1 and 2: Count both edges
6 - 7	0
5	0 .... No effect on counter 2 1 .... Immediately clear counter 2
4	0 .... No effect on counter 1 1 .... Immediately clear counter 1
3	0 .... Comparator off Output 1 is handled as defined in the variable declaration for digital outputs. 1 .... Comparator on
2	0 .... The comparator output is set to the level given in bit 0, if threshold value 1 ≤ counter ≤ threshold value 2 1 .... The comparator output is set to the inverted level of bit 0, if threshold value 1 ≤ counter ≤ threshold value 2
1	0
0	Level of the comparator output

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	1	0		0		0	0					0	

13.5.19 Variable Declaration for the Digital Outputs

The variable declaration is valid for the following controllers:

- 2003 PCC CPU
- Remote I/O Bus Controller
- CAN Bus Controller

The variable declaration is made in PG2000. The variable declaration is described in Chapter 4, "Module Addressing".

Automation Studio™ Support: See Automation Studio™ Help starting with V 1.40

Accessing screw-in modules is also explained in the sections "AF101" and "CPU".

Data access takes place using data and configuration words. The following table provides an overview of which data and configuration words are used for the digital outputs.

Data Access	VD Data Type	VD Module Type	VD Chan.	R	W	Description
Data word 0	WORD	Transp. Out	0		●	Digital outputs 0 and 1
Configuration word 14	WORD	Transp. In	28	●		Module type

Access using CAN Identifiers

Access via CAN Identifiers is used if the slave is being controlled by a device from another manufacturer. Access via CAN Identifiers is described in an example in Chapter 4, "Module Addressing".
The transfer modes are explained in Chapter 5, "CAN Bus Controller Functions".

In the example below, the combination module CM411 is accessed with module addresses 1 and 2.

Digital output data cannot be packed. Only the second object from this group of four will be created.

<table>
<tr><th>Slot</th><th>CAN ID [1]</th><th colspan="2">Word 1</th><th>Word 2</th><th>Word 3</th><th>Word 4</th></tr>
<tr><td>1</td><td>1058</td><td colspan="5">Not used</td></tr>
<tr><td>2</td><td>1059</td><td>Output L</td><td>Output H</td><td colspan="3">Not used</td></tr>
<tr><td>3</td><td>1060</td><td colspan="5">Not used</td></tr>
<tr><td>4</td><td>1061</td><td colspan="5">Not used</td></tr>
</table>

[1] CAN ID = 1054 + (nd - 1) x 16 + (ma - 1) x 4 + (sl - 1)
nd ..... Node number of the CAN slave = 1
ma .... Module address = 2
sl .... Slot number = 2

B&R 2000 users have to exchange the data so that the high data is first (Motorola format)!

For more information on ID allocation, see Chapter 5, "CAN Bus Controller Functions".

Description of Data and Configuration Words

Data Word 0 (write)

State of the digital outputs 0 and 1. Bits 2 to 15 must be 0.

Bit	Description
2 - 15	0
1	Digital output 1
0	Digital output 0 Status of output 0, if the comparator is switched off.

15							8	7							0
0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Configuration Word 14 (read)

The High Byte of configuration word 14 defines the module code.

Bit	Description
8 - 15	Module code = $38
0 - 7	x ....Not defined, masked out

15							8	7							0
0	0	1	1	1	0	0	0	x	x	x	x	x	x	x	x