ВИБРО
БИТ

SCIENTIFIC PRODUCTION
ENTERPRISE VIBROBIT LLC

EQUIPMENT "VIBROBIT 300"

CAN interfaces splitter
BRCAN01
Setup Instruction

ВШПА.421412.4003 И2

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General

BRCAN01 unit is intended for logic and galvanic isolation between two different CAN interfaces, in particular between the stand internal CAN interface and external CAN interface with connected БИ24 indication unit. The implemented CAN interface protocol is CAN 2.0B.

The BRCAN01 is based on a high-performance 32-bit microcontroller. Interface splitter BRCAN01 has the software filtering function of messages transmitted from one CAN interface to another. It is possible to configure both CAN interfaces for different data rates, to provide high speed data transfer via the internal CAN interface and low data transfer rate to the external CAN interface (long distances - БИ24).

Also provided is the bidirectional data transfer mode between CAN interfaces.

Interface splitter BRCAN01 is installed on the DIN-rail in stand. The supplied power is (18 - 36) VDC.

The LED indication on the front panel displays the status of BRCAN01 splitter, its input and output lines of CAN interface.

To ensure impulse noise and static discharges immunity, the BRCAN01 interface splitter has the appropriate protection circuits on the digital lines of CAN interfaces and power lines.

All settings of the BRCAN01 interface splitter are carried out using a personal computer. To setup BRCAN01 on a computer, it is necessary to start the ModuleConfigurator.exe program, connect the BRCAN01 interface splitter to the computer via the MC01USB or MC03Bluetooth module, via the front panel connector.

Indication means

Provided in BRCAN01 interface splitter are 6 signal LEDs, installed on module front panel:

- Green LED “Pwr” - normal power supply voltage indication;
- Bi-color LED “Ok” - module status indication:
  - Green color: Continuous glow corresponds to BRCAN01 normal operation;

    Blinking at 1 Hz frequency for 10 seconds corresponds to the cold start waiting mode in normal operating mode; continuous blinking with 1 Hz frequency: operation parameters are loaded from reserve data section.
  - Red color: Continuous glow indicates BRCAN01 internal error or operation blocking; blinking at 1 Hz frequency for 10 seconds corresponds to the cold-start waiting mode in the blocked state; If errors occur on CAN buses or buffer overflows, the red LED engages briefly.
- Green LED ‘Rx1’ - short-time activation when receiving messages via CAN1;
- Green LED ‘Tx1’ - short-time activation when transmitting messages via CAN1;
- Green LED ‘Rx2’ - short-time activation when receiving messages via CAN2;
- Green LED ‘Tx2’ - short-time activation when transmitting messages via CAN2;

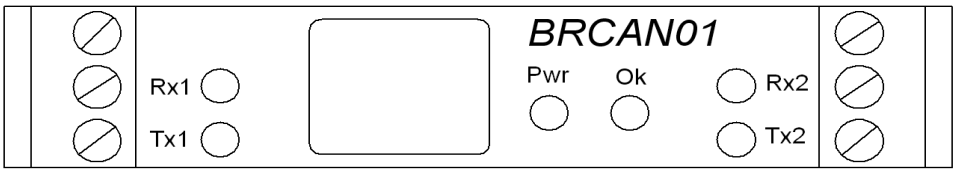

Figure 1. BRCAN01 front panel appearance

Unit operation

Power-up

Upon power-up, the operating parameters are loaded from non-volatile memory. Operating parameters are divided into sections:

- BRCAN01 main parameters;
- Filters and masks for CAN1.
- Filters and masks for CAN2.

Each operating parameters section in non-volatile memory is accompanied with a check sum, permitting to check authenticity of loaded data. If calculated check sum is not the same as recorded sum in non-volatile memory, then data are considered damaged and unfit for operation.

Each data section in non-volatile memory has main and reserve allocation. If operating parameters section from non-volatile memory is read with error, then attempt is made to read the data from non-volatile memory reserve area.

If an error is detected in one of operating parameters sections (from main or reserve section), then BRCAN01 unit operation is blocked.

Reset

Carried out during BRCAN01 unit reset is microcontroller hardware reset and carried out is a sequence of actions, corresponding to power-up. Reset reasons include:

- power-up;
- reset upon user’s command (command by diagnostic communication interface);
- microprocessor power supply voltage drop (power source malfunction);
- reset according to watchdog timer due to microprocessor program “hang-up”.

User can implement I2C diagnostic interface commands to carry out BRCAN01 unit reset and “Cold start”.

BRCAN01 “cold start”

“Cold” start is intended to record default settings to BRCAN01 unit non-volatile memory. This function is useful during module first power-up after assembly or if it is necessary to carry out module repeated setup.

Switching to “Cold Start” mode is carried out by two commands from I2C diagnostic interface: “Cold start execution request” and “Cold start execution".

Execute “Cold start execution request” command to switch to “Cold Start” execution waiting mode. “OK” LED flashing for 10 sec. after executing the command, indicates switching to “Cold Start” execution waiting mode.

If “Cold start execution” command is not executed within 10 seconds, BRCAN01 unit will switch to normal operation mode.

BRCAN01 parameters setting

CAN interface splitter BRCAN01 has two galvanically isolated hardware CAN interfaces with CAN 2.0B protocol support. Data packets are transmitted between interfaces in automatic mode according to BRCAN01 settings. CAN controllers BRCAN01 operates in active mode, i.e. generates dominant confirmation of received messages.

Main parameters for BRCAN01 setting:

- Data transmission direction *(Route_CAN)*: off; from CAN1 to CAN2; from CAN2 to CAN1; in both directions.
- CAN1 interface data rate *(Speed_CAN1)*: from 40 kbit/s to 1000 kbit/s
- CAN2 interface data rate *(Speed_CAN2)*: from 40 kbit/s to 1000 kbit/s
- Minimum pause between packets when transmitting via CAN1 *(Time_send_mes_CAN1)* — from 2 ms to 1000 ms.
- Minimum pause between packets when transmitting via CAN2 *(Time_send_mes_CAN2)* — from 2 ms to 1000 ms.
- Waiting time for packet sending via CAN1, CAN2 *(Time_Out_Send)*– from 50 ms to 1000 ms.

To ensure data packets selective transmission between CAN interfaces, filters and masks are configured by transmitted data address and type for each interface individually:

- Filters and masks for CAN1 interface;
- Filters and masks for CAN2 interface;

The following procedure describes configuring of BRCAN01 unit CAN interfaces filters and mask.

CAN2.0B controller works only with extended messages with 29-bit address, consisting of:

- 11-bit standard address (SID10: SID0);
- 18-bit extended message address (EID17: EID0).

11-bit standard address includes the transmitter module code (8 bits):

- SID10:SID8 - 3-bits always equal to 110 for Vibrobit 300 control modules;
- SID7:SID0 - 8-bit module code

18-bit extended address includes the transmitter module number (16 bits):

- EID17:EID16 - 2-bits always equal to 10 for Vibrobit 300 control modules;
- EID15:EID0 – 16-bit transmitter module number

1. Parameter "*SID filter*" is specified in hexadecimal format. The module code is given in Vibrobit 300 equipment control modules Setup Instruction.

Example. МК32 module code — 0x32, Parameter «SID filter» accordingly — 0x632;

МК22 module code — 0x22, Parameter «SID filter» accordingly — 0x622;

2. Parameter "*SID mask*" is specified in hexadecimal format. *«SID mask»* is a bit representation of *«SID filter»* parameter importance. All "*SID mask*" bits (0x7FF) set to "1" configure the "*SID filter*" to match all filter bits completely. Thus message will be received into clipboard for further transmission if "SID" parameter received in the message and specified in setting ("*SID filter*" parameter) match completely. Zero value of all *«SID mask»* bits (0x000) - completely disables filter by "*SID filter*" parameter.

Example. It is necessary to receive a message with the following SID to clipboard for further sending: 0x632 (МК32), 0x622 (МК22). «SID mask» parameter can be determined as follows:

*2.*1. Discard the high "0x6" from the SID values, since all Vibrobit 300 control modules have only 8-bit (1 byte) SID.

2.2. Represent SIDs of interest in binary form: 0x32 = 0b00110010, 0x22 = 0b00100010

2.3. Carry out the "exclusive-OR" operation between all operands: P = 0b00010000

2.4. Inverse result: Pi = 0b11101111 = 0xEF

2.5. Add the high "0x7" to the result, (setting the three high SID bits to "1") Prez = 0x7EF

2.6. The resulting value is recorded into parameter "*SID mask*".

3. Parameter "*EID filter*" is specified in hexadecimal format. Transmitter number (address)

Example. МК32 module address — 125, parameter «EID filter» accordingly — 0x2007D;

МК22 module address — 127, parameter «EID filter» accordingly — 0x2007F.

4. "SID mask" parameter is specified in hexadecimal format, assigning is similar to "SID mask" parameter.

Example. It is necessary to receive a message with the following EID to clipboard for further sending: 0x2007D, 0x2007F. «EID mask» parameter can be determined as follows:

*4.*1. Discard the high "0x2" from the EID values, since all Vibrobit 300 control modules have only 16-bit (2 byte) SID.

4.2. Represent EID of interest in binary form: 0x007D = 0b00000000 01111101,

0x007F = 0b00000000 01111111

4.3. Carry out the "exclusive-OR" operation between all operands: P = 0b00000000 00000010

4.4. Inverse result: Pi = 0b11111111 11111101 = 0xFFFD

4.5. Add the high "0x3" to the result, (setting two high EID bits to "1") Prez = 0x3FFFD

4.6. The resulting value is recorded into parameter "*EID mask*".

5. Parameter "*Data type filter*" is specified in hexadecimal format. "*Data type*" code is given in Vibrobit 300 equipment control modules Setup Instruction.

Example. "*Data type*" code *of channel 1 main measured parameter value for MK32 — 0x30;*

"Data type" code of channel 2 main measured parameter value for MK22 — 0x40;

6. Parameter "*Data type mask*" is specified in hexadecimal format. Assigning is similar to "SID mask" parameter.

Example. It is necessary to receive a message with the following "Data types" to clipboard for further sending: 0x30, 0x40. «Data type mask» parameter can be determined as follows:

4.1. Represent "*Data types*" of interest in binary form: 0x30 = 0b00110000,

0x40 = 0b01000000;

4.3. Carry out the "exclusive-OR" operation between all operands: P = 0b01110000;

4.4. Inverse result: Pi = 0b10001111 = 0x8F;

4.6. The resulting value is recorded into parameter «*Data type mask*»*.*

Status flags

Table 1. System flags `StatusSys`

Bit No.	Designation	Description
0	`ErrorLoadData`	Operation parameters read error from non-volatile memory
1	`LoadDataReserv`	One or several operating parameters groups read from non-volatile memory reserve section
2	`AllowOneWrite`	Cold start access received
3	`ERR_CAN_BUS`	CAN interface error
4	`START_DEVICE`	Device operates

Table 2. System status additional flags StatusSysAdd

Bit No.	Designation	Description
0	`SaveExecut`	Recording into non-volatile memory
1	`SaveGood`	Recording completed properly
2	`SaveFailure`	Recording executed with errors

Table 3. Flags of data loading by sections ErrorLoad

Bit No.	Designation	Description
0	`Param_Filtr_Mask_CAN1`	Loading error of CAN1 parameters "Filters and masks" from main and reserve bank
1	`Param_Filtr_Mask_CAN2`	Loading error of CAN2 parameters "Filters and masks" from main and reserve bank
2	`Param_BRCAN`	Main parameters loading error from main and reserve bank
3	`ID_Data_bit`	Identification data loading error from main and reserve bank

Table 4. Flags of data loading from reserve section ReservLoad

Bit No.	Designation	Description
0	Param_Filtr_Mask_CAN1_R	CAN1 parameters “Filters and masks” loaded successfully from reserve bank
1	Param_Filtr_Mask_CAN2_R	CAN2 parameters “Filters and masks” loaded successfully from reserve bank
2	Param_BRCAN_R	Main parameters loaded successfully from reserve bank
3	ID_Data_bit_R	Identification data loaded successfully from reserve bank

I2C slave interface

I2C slave interface is intended to control interfaces splitter BRCAN01 operation and setup its operation parameters. I2C slave interface parameters are rigidly predetermined, therefore regardless of BRCAN01 current status, the I2C interface is always available for control.

All settings of BRCAN01 interface splitter are carried out using a personal computer. To setup BRCAN01 on a computer, it is necessary to start the ModuleConfigurator.exe program, connect the BRCAN01 interface splitter to the computer via the MC01USB or MC03Bluetooth module, via the front panel connector.

Table 5. I2C slave interface parameters

Parameter description	Value
BRCAN01 address on I2C interface	0x56
Address format when accessing module registers	16-bit
Data rate, kbit/s, max	400
VDC on diagnostics connector to power matching device, V	5 ± 0.2
Permissible consumption current in power supply circuit on diagnostics connector, mA, max	50
Galvanic isolation	none

Note. BRCAN01 interface splitter provides “hot” connection/disconnection of MC01USB, MC03Bluetooth diagnostic interface modules.

BRCAN01 module settings and current status (address tables)

Module main parameters and system settings:

Table 6. List of main operation parameters

Description	Designation	Type (bytes)	Address (Hex)	Default value	Note
Data transmission direction 0 – off; 1 - CAN1->CAN2; 2 - CAN2->CAN1; 3 - CAN1<->CAN2.	UChar	UChar(1)	0x0100	1	1
Data rate for CAN1,kbit/s 0 - 1000, 1 - 500, 2 - 250, 3 - 200, 4 - 125, 5 - 100, 6 - 40	Speed_CAN1	UChar(1)	0x0101	0	1
Data rate for CAN2,kbit/s 0 - 1000, 1 - 500, 2 - 250, 3 - 200, 4 - 125, 5 - 100, 6 - 40	Speed_CAN2	UChar(1)	0x0102	6	1
Minimum pause between packets when transmitting via CAN1, ms.	Time_send_mes_CAN1	Uint (2)	0x0104	50	1
Minimum pause between packets when transmitting via CAN2, ms.	Time_send_mes_CAN2	Uint (2)	0x0106	50	1
Waiting time for packet sending via CAN1, CAN2, ms.	Time_Out_Send	Ulong(4)	0x0108	100	1

Note:

1. Default value – value assigned to parameter after “Cold start”.

Table 7. Parameters list for CAN1 and CAN2 interfaces filter and mask setting

Description	Designation	Type (bytes)	Address (Hex)	Default value	Note
SID filter for CAN1 (hex)	Filtr_CAN1.SID	Ulong(4)	0400	0x6FF	1
SID mask for CAN1 (hex)	Mask_CAN1.SID	Ulong(4)	0408	0x000	1
EID filter for CAN1 (hex)	Filtr_CAN1.EID	Ulong(4)	0404	0x200FF	1
EID mask for CAN1 (hex)	Mask_CAN1.EID	Ulong(4)	040C	0x00000	1
Data type filter for CAN1 (hex)	Filtr_CAN1_Type_Data	UChar(1)	0410	0xFF	1
Data type mask for CAN1 (hex)	Mask_CAN1_Type_Data	UChar(1)	0411	0x00	1
SID filter for CAN2 (hex)	Filtr_CAN2.SID	Ulong(4)	0500	0x6FF	1
SID mask for CAN2 (hex)	Mask_CAN2.SID	Ulong(4)	0508	0x000	1
EID filter for CAN2 (hex)	Filtr_CAN2.EID	Ulong(4)	0504	0x200FF	1
EID mask for CAN2 (hex)	Mask_CAN2.EID	Ulong(4)	050C	0x00000	1
Data type filter for CAN2 (hex)	Filtr_CAN2_Type_Data	UChar(1)	0510	0xFF	1
Data type mask for CAN2 (hex)	Mask_CAN2_Type_Data	UChar(1)	0511	0x00	1

Note:

1. Default value – value assigned to parameter after “Cold start”.

BRCAN01 module current status

Table 8. List of current operation parameters

Description	Designation	Type (bytes)	Address (Hex)	Default value	Note
New messages counter in CAN1 receive buffer	count_mess_C1_C2	Ulong(4)	0x0700		1
New messages counter in CAN2 receive buffer	count_mess_C2_C1	Ulong(4)	0x0704		1
CAN1 buffer overflow counter	count_overfl_C1_Rx	Ulong(4)	0x070C		2
CAN2 buffer overflow counter	count_overfl_C2_Rx	Ulong(4)	0x0710		2
Total resets counter of CAN1 and CAN2 modules	count_Reset_C1_C2	Ulong(4)	0x0708		3

Notes:

1. Receive buffers for the CAN1 and CAN2 interfaces have a depth of 256 messages.
2. Overflow can occur with improperly configured data rates of CAN1 and CAN2 interfaces, incorrectly configured filters and masks, as well as high message overflow of CAN interfaces.
3. Resets counter displays the total number of CAN1 and CAN2 modules restarts due to errors on CAN bus interfaces.

Identification information

Table 9. List of converter identification information registers

Description	Designation	Type (bytes)	Address (Hex)	Default value	Note
Module factory number	Number	Uint (2)	0x0C00		
Module manufacturing year	Year	Uint (2)	0x0C02		
Order number	Order	Uint (2)	0x0C04		
Assembler’s code	Assembler	UChar (1)	0x0C06		
Adjuster’s code	Adjuster	UChar (1)	0x0C07		
Additional text information	TextString	Char (32)	0x0C08		

Note. Identification information is available read-only, not initialized by “Cold start”.

Table 10. List of converter software identification information registers

Description	Designation	Type (bytes)	Address (Hex)	Default value	Note
Microcontroller software version line	Version	Char (6)	0x0D00		
Microcontroller software compilation date	Date	Char (12)	0x0D06		
Microcontroller software compilation time	Time	Char (9)	0x0D12		

Note. Identification information is available read-only.

Control commands

Several reserved registers are provided for control commands execution. Control commands are executed only during individual recording into each register (it is impossible to execute several control commands per one data transaction).

Table 11. List of control registers

Register address (Hex)	Recorded value (Hex)	Action	Note
0xFF00	0x55	Module reset (similar to module power-up)	
0xFF01	0x62	Repeated initialization of CAN 1 and CAN2 interfaces	1, 3
0xFF03	0x3C	Request for single recording permission (for cold start execution)	
0xFF05	0x22	Cold start	2
0xFF07	0x21	Recording all module settings into non-volatile memory	4.5

Notes:

1. Can be used after setup to check changes without module reboot.
2. To carry out cold start procedure, first it is necessary to execute the “Cold start execution request” command and then execute the “Cold start” command within 10 seconds.
3. Module is not rebooted after recording.
4. Module operation is stopped during recording. Reset is carried out automatically after recording.
5. When executing “Record all module settings to non-volatile memory” command, the identification data are not saved in the non-volatile memory.

Maintenance

For maintenance information refer to document ВШПА.421412.300 РЭ Equipment VIBROBIT 300 Operation and Maintenance Manual:

- equipment maintenance;
- routine repair;
- equipment check.

Transportation and storage

Transport using any transport means, providing protection from exposure to atmospheric precipitation and water splash according to the transportation rules, effective on all transport means.

During airborne transportation the equipment should be arranged in heated pressurized compartment.

Transportation conditions – Ж according to ГОСТ 23216-78.

Equipment storage with regard to environment climatic aspects influence should correspond to group Ж3 according to ГОСТ 15150-69.

Storage time 6 months max after shipping date.

Manufacturer’s warranty

Manufacturer guarantees the equipment compliance with specifications when observing operation, storage, transportation and installation conditions.

Guarantee service life is 24 months since placed into service, but not more than 30 months since manufacturing date.

If module is sent to Manufacturer for repair, it is necessary to state the detected failure.

Appendices

A. Regulating controls arrangement on BRCAN01 board

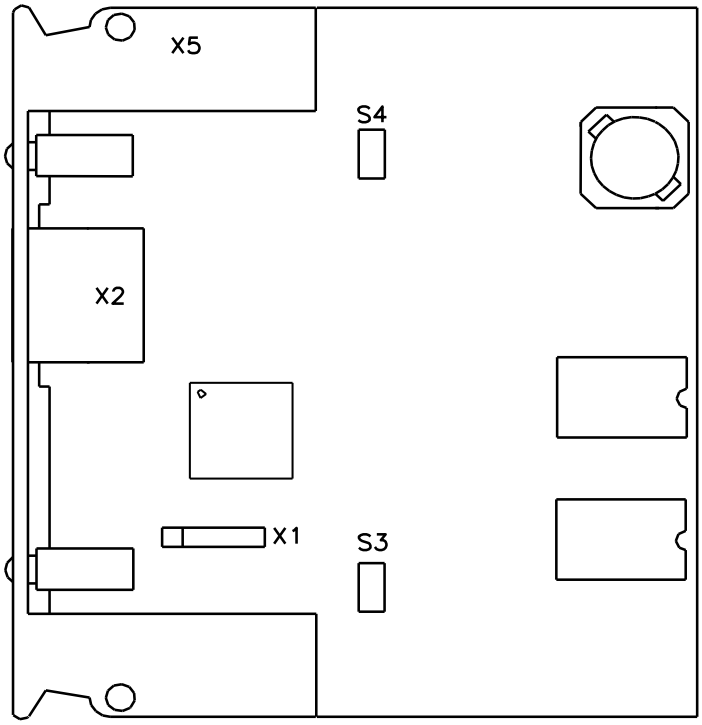

Figure 2. Elements arrangement on BRCAN01 board

Jumpers S3, S4 – terminator 120 Ohm of bus CAN2 and CAN1 correspondingly

Position	Mode
Removed	Terminator disconnected from bus
Installed	Terminator connected to bus

B. Connector terminals purpose

Table B.1 - Connector X1 terminals purpose - microcontroller programming connector

Terminal number	Designation	Purpose	Note
1	MCLR	Programming interface line MCLR	
2	+5V	Power output +5V	
3	GND	Common	
4	PGD	Programming interface line PGD	
5	PGC	Programming interface line PGD	

Table B.2 - Connector X2 terminals purpose - I2C diagnostic interface

Terminal number	Designation	Purpose	Note
1	Test +5V	Power output +5V to power MC01USB board	
2	Test SCL	I2C interface synchronization line	
3	Test SDA	I2C interface data line	
4	Test GND	Common	

Table B.3 - Connector X5 terminals purpose

Terminal number	Designation	Purpose	Note
1	+24B	Power supply voltage input +24V	
2	CAN1-L	CAN1 interface line L	
3	CAN1-H	CAN1 interface line H	
4	CAN2-L	CAN2 interface line L	
5	CAN2-H	CAN2 interface line H	
6	GND	Common	

List of tables