

## BCU01 Pneumatic Brake Actuator



This is a dual channel, fully redundant brake control unit designed for use on autonomous vehicles fitted with an air brake system. The BCU can be used in conjunction with the existing brake system or standalone.

### Features

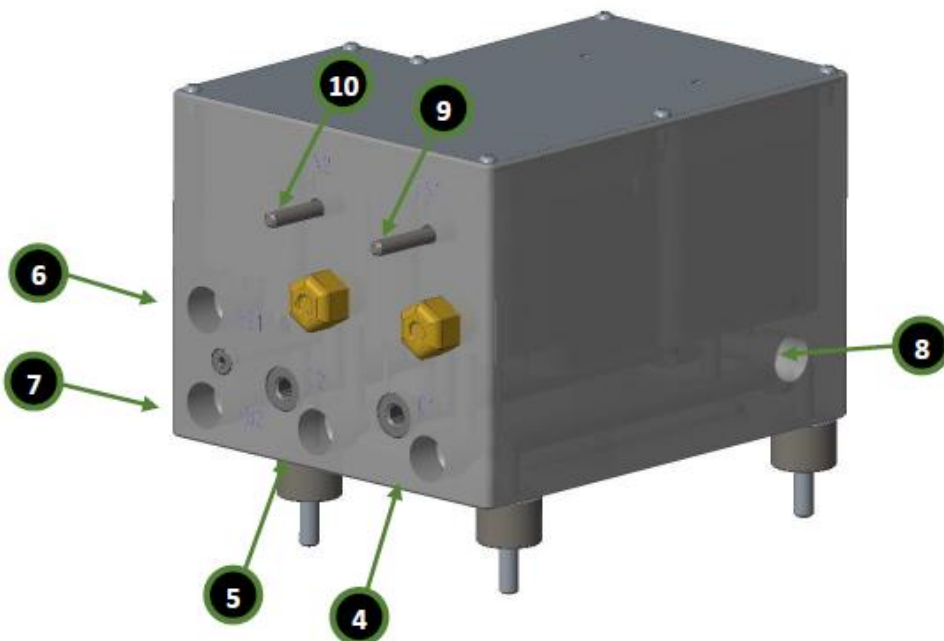
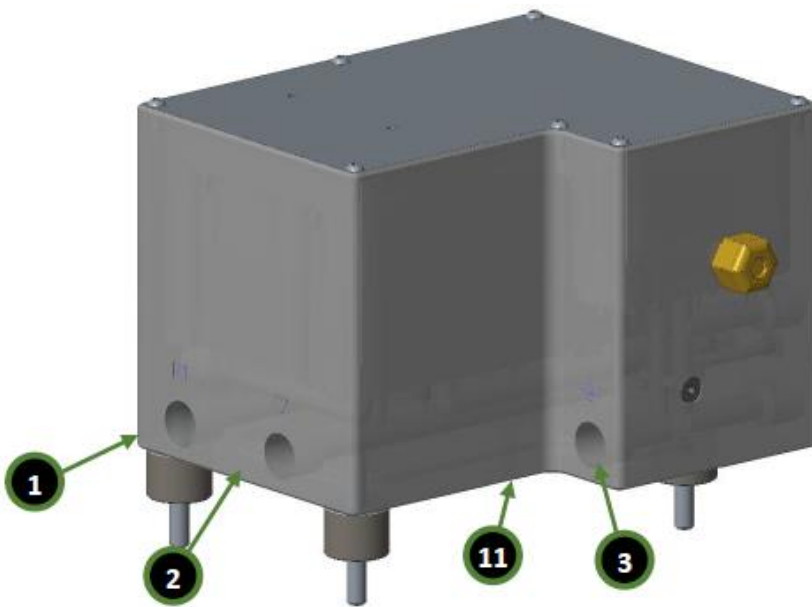
- 2 Independent proportional valves for brake actuation
- Each proportional valve has its own independent control ECU
- Shared “Handbrake” output valve (twin ports) with control from either ECU
- CAN operated (2 CANs on each port)
- Pressure & Temperature monitoring
- Integrated data-logging
- Designed for 12V or 24VDC operation
- Independent air supply input for each valve
- Independent power supply for each ECU

### Technical Specification

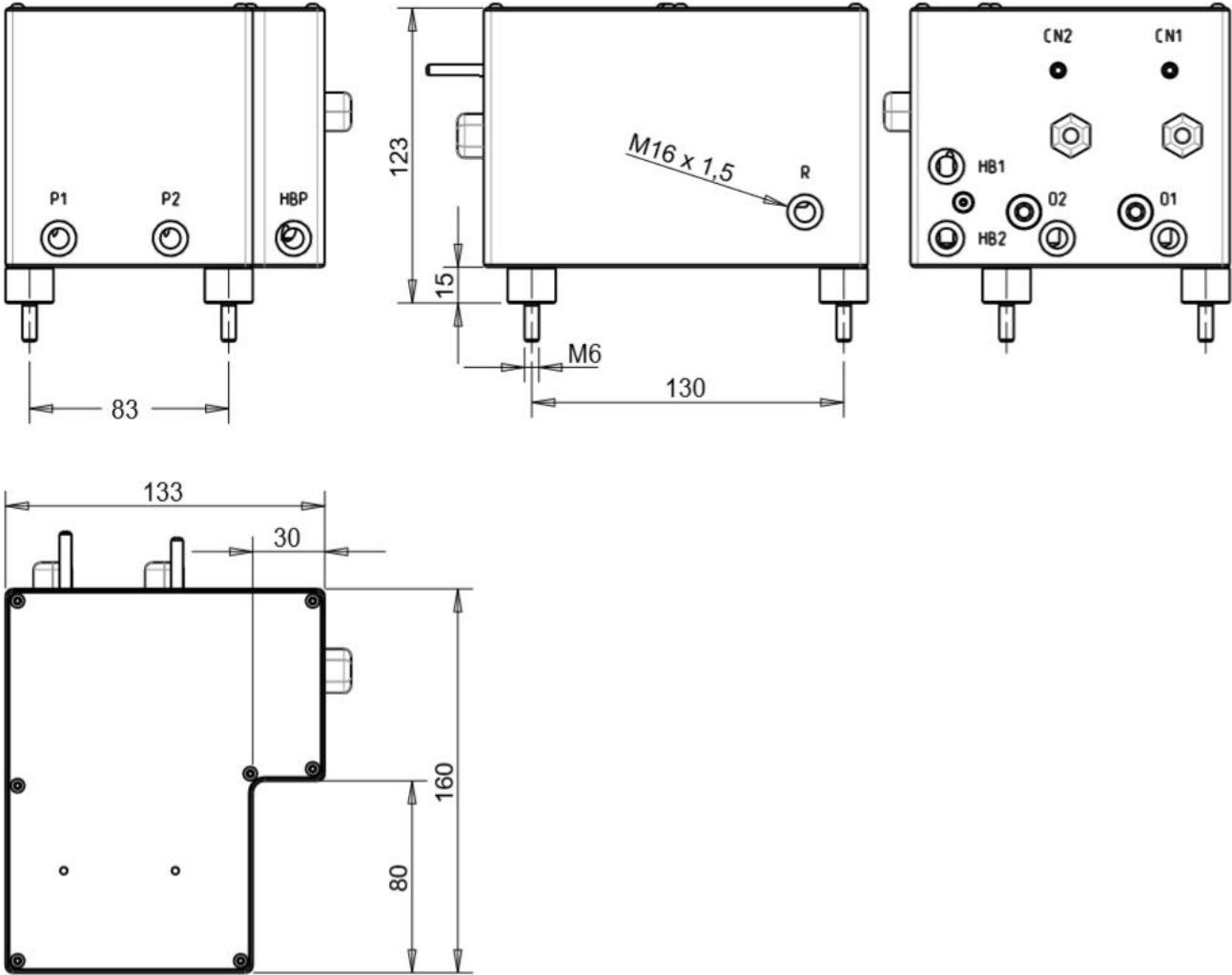
Dimensions L x W x H	160 x 133 x 123 mm
Weight	3.7 kg
Operating temperature	0 ... 70 °C (block temperature)
System Input pressure	5 ... 10 Bar
Output pressure (each port)	0 .. 10 Bar
Operating voltage	7V ... 30V

## Connection Diagram

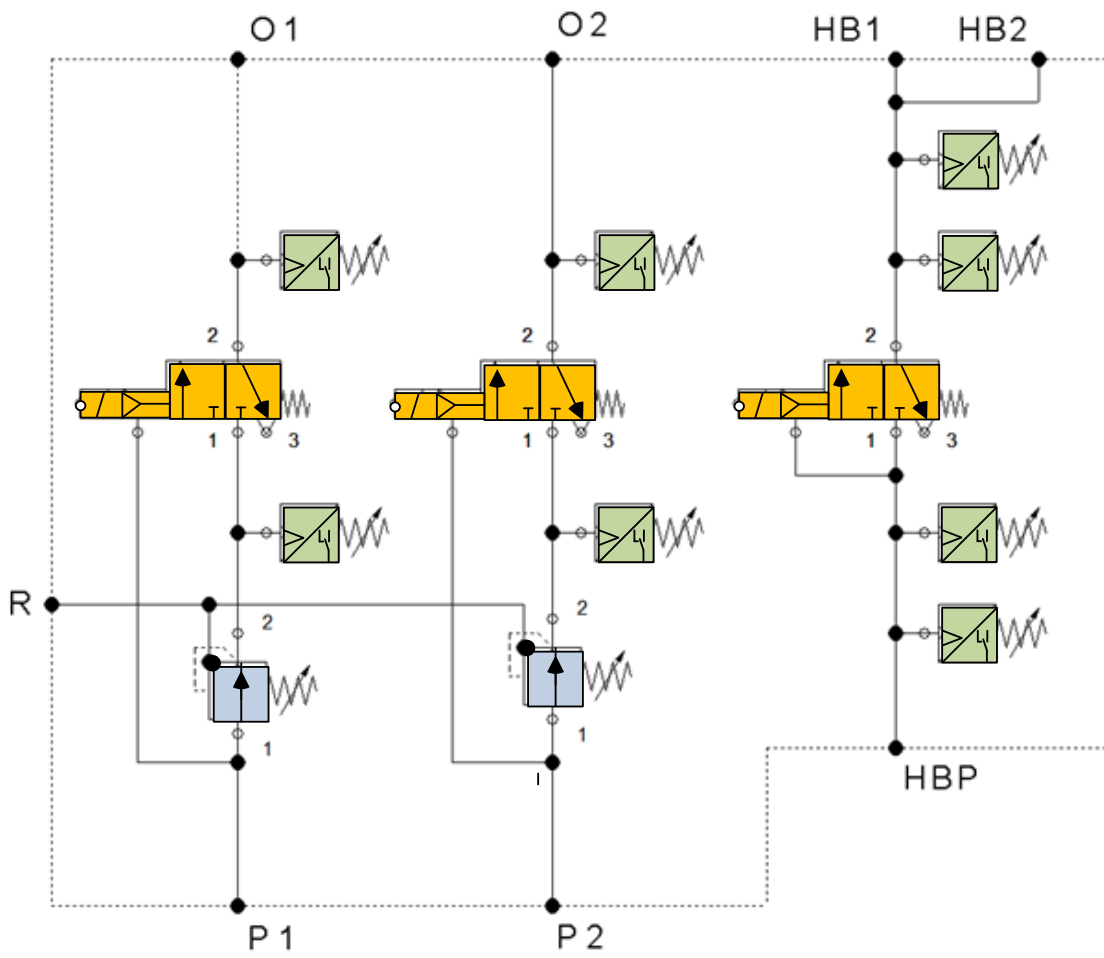
- ① Pressure supply port P1
- ② Pressure supply port P2
- ③ Hand brake pressure supply port HBP
- ④ Pressure output port O1
- ⑤ Pressure output port O2
- ⑥ Hand brake pressure output port HB1
- ⑦ Hand brake pressure output port HB2
- ⑧ Exhaust port R
- ⑨ Electrical cable CN1
- ⑩ Electrical cable CN2
- ⑪ Chassis ground connection



Dimensional Drawing



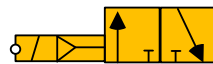
Pneumatic Scheme



PROPORTIONAL VALVE



PRESSURE SENSOR



VALVE

## Wiring & Connecting

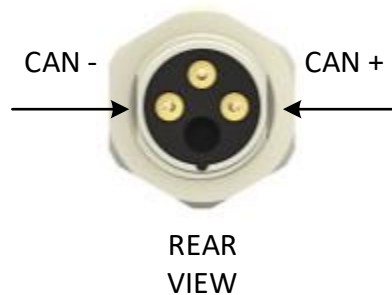
- Using 18awg / 0.75mm wire, connect vehicle chassis ground to the bottom of BCU01. See connection diagram for ground location. Ensure chassis ground is as close to the product as possible and that the connections are good and well connected.
- Cable marked with CN1 represents output port 1 (O1)
- Cable marked with CN2 represents output port 2 (O2)

Wire Color	Function	DTM04-6P
Brown	Supply voltage	1
Blue	Ground	2
Yellow	CAN1+	3
Green	CAN1-	4
White	CAN2+	5
Grey	CAN2-	6
Red, Pink	N.C.	

Mating connector is Deutsch DTM06-6S

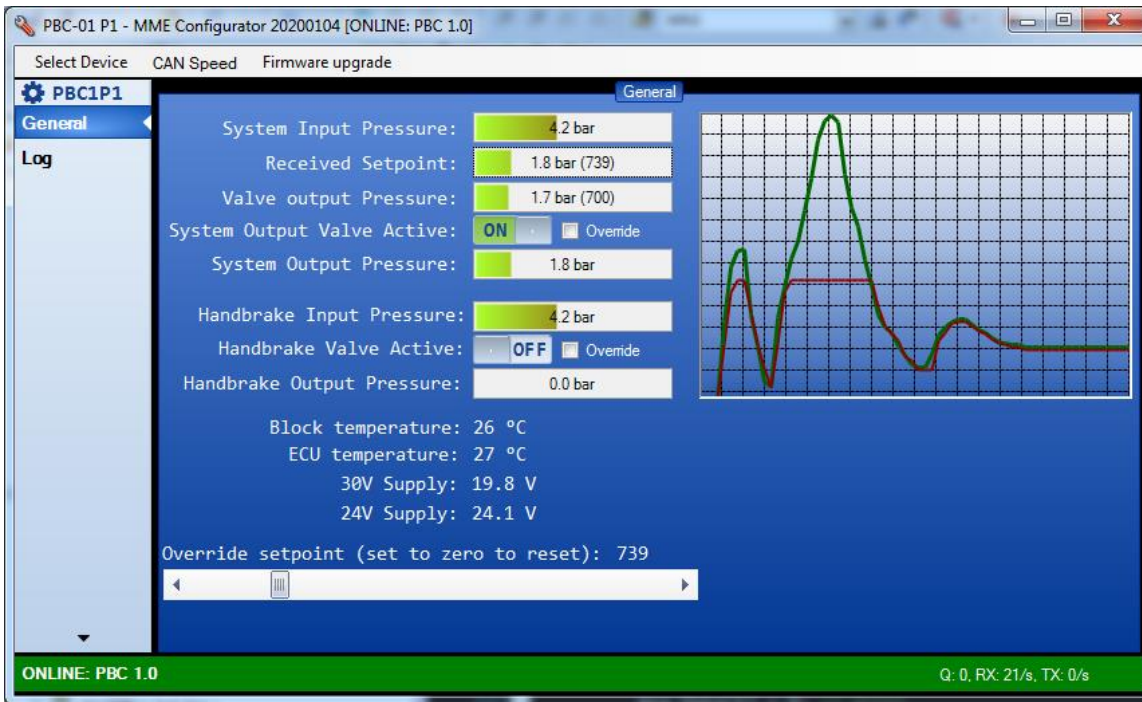
### Connecting to the PC:

With each system we supply a small 3 pin connector (TE part number T4042014031-000) to be connected into your vehicles CAN bus to allow communication with the BCU. It is wired as follows:



Contact us if you require the USB to CAN communication cable part number BCU01UTC.

Please download the latest MME Configurator from <http://www.mme-motorsport.com/en/download>



## CAN BUS information

CAN speed = Auto Detect (100/250/500/1000K Baud Rate)

P1 base = 0x500, P2 base = 0x510

### CAN Broadcasting Data Set

ID	B0	B1	B2	B3	B4	B5	B6	B7
base	bits1	bits2	p.vlv.setpointH	p.vlv.setpointL	p.vlv.outH	p.vlv.outL	error	crc
base+0x1	supply24V	supply30V	p.supply	p.output	p.hb.input	p.hb.output	free	crc
base+0x2	t.block	t.cpu	free	free	free	free	free	crc

<b>bits1</b>	b0 - output valve active b1 – handbrake valve active b2-b7 – free
<b>bits2</b>	b0-b7 – free
<b>p.vlv.setpointH+L</b>	received setpoint (H*256 + L). 0 = 0 bar, 4095 = 10 bar
<b>p.vlv.outH+L</b>	output pressure directly at the proportional valve, before the output valve (H*256 + L). 0 = 0 bar, 4095 = 10 bar
<b>error</b>	error number ( <i>not implemented yet</i> )
<b>crc</b>	crc checksum. Formula used: 1 + B0 + B1 + B2 + B3 + B4 + B5 + B6
<b>supply24V</b>	voltage supply at the output regulator. $V=(5+(X/255)*30)$
<b>supply30V</b>	input voltage supply. $V=(5+(X/255)*30)$
<b>p.supply</b>	Input pressure supply (P1 and P2). $P = X/10.0$
<b>p.output</b>	Output pressure (O1 and O2). $P = X/10.0$
<b>p.hb.input</b>	Input pressure on handbrake port (HBP). $P = X/10.0$
<b>p.hb.output</b>	Output pressure on the handbrake port (HB1+HB2). $P = X/10.0$
<b>t.block</b>	Temperature of the valve block. $T=-40+X$
<b>t.cpu</b>	CPU temperature. $T=-40+X$

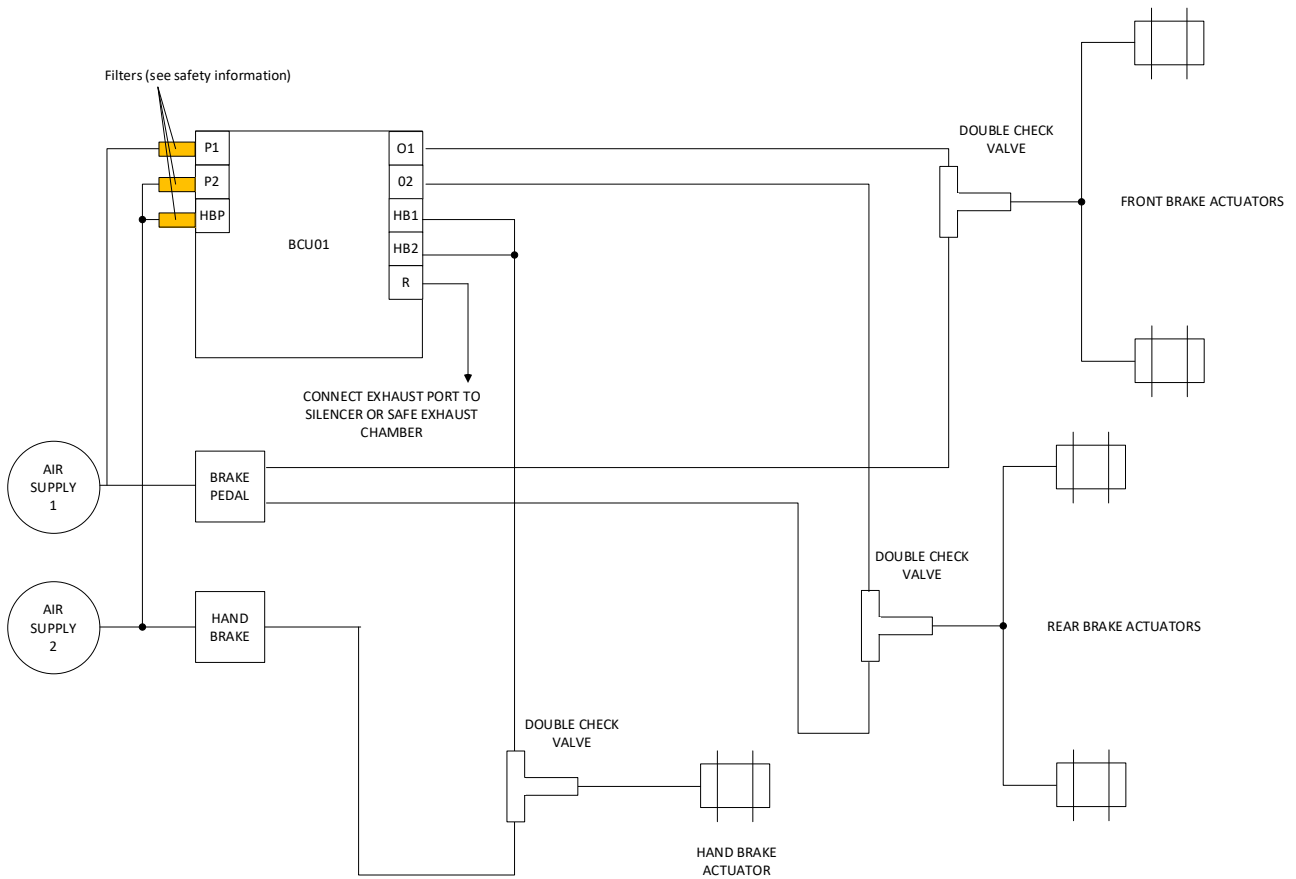
## CAN Commands

ID	B0	B1	B2	B3	B4	B5	B6	B7
base+0x100	p.setpointH	p.setpointL	hb	free	free	free	timestamp	crc

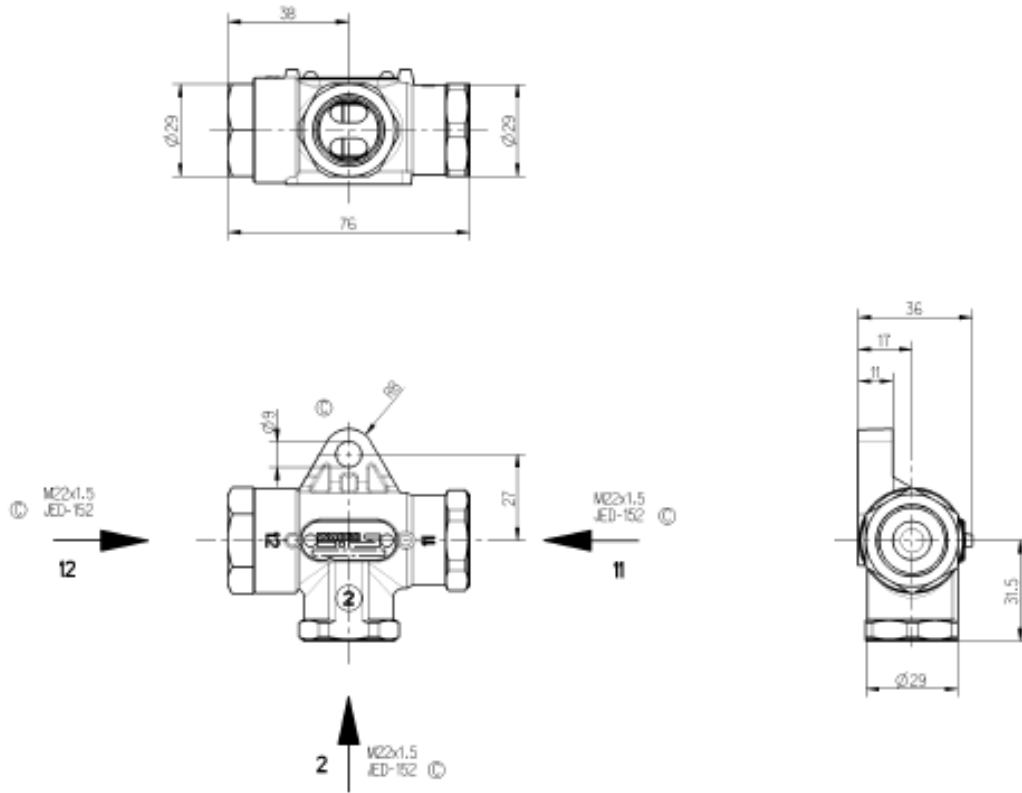
<b>p.setpointH+L</b>	set setpoint (MSB). 0=0 bar, 4095 = 10 bar																											
<b>hb</b>	<p>set handbrake:            0 – no change            1 – handbrake on (HB1+HB2 pressurized)            2 – handbrake off (HB1+Hb2 released)</p> <table border="1"> <thead> <tr> <th>P1 hb</th> <th>P2 hb</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>No change</td> </tr> <tr> <td>X</td> <td>1</td> <td>Handbrake on</td> </tr> <tr> <td>1</td> <td>X</td> <td>Handbrake on</td> </tr> <tr> <td>1</td> <td>2</td> <td>Handbrake on</td> </tr> <tr> <td>2</td> <td>1</td> <td>Handbrake on</td> </tr> <tr> <td>0</td> <td>2</td> <td>Handbrake off (if other hb is not active)</td> </tr> <tr> <td>2</td> <td>0</td> <td>Handbrake off (if other hb is not active)</td> </tr> <tr> <td>2</td> <td>2</td> <td>Handbrake off</td> </tr> </tbody> </table>	P1 hb	P2 hb	Result	0	0	No change	X	1	Handbrake on	1	X	Handbrake on	1	2	Handbrake on	2	1	Handbrake on	0	2	Handbrake off (if other hb is not active)	2	0	Handbrake off (if other hb is not active)	2	2	Handbrake off
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<b>timestamp</b>	last sent timestamp+1. On power up, last timestamp=0. For command to take effect, timestamp has to be higher than the last timestamp (8 bit value)																											
<b>crc</b>	Formula: $1 + B0 + B1 + B2 + B3 + B4 + B5 + B6$ If this is not correct the command will be ignored.																											



# Typical Pneumatic Installation



Example Check Valve



General Specification		43-534-0		Copyright WABCO®		<b>WABCO</b>	
Further Technical Data				Date		2008-01-08	
Des. Date				2008-01-08		Ante	
General Tolerances		AS 201		2008-01-08		Zweiwege Ventil	
Range of Nominal Dimensions		1 & 2 mm		2008-01-08		Serielle	
Class		1		2008-01-08		Doppia Valvola d'Arresto	
Fire		0,5 1,0 1,5 2,0		Max		1,1	
Medium		1,0 2,0 3,0 4,0		Rate		1,1	
Control		2,0 3,5 5,0 6,5		A 2		510	
Fitted Hole		Ø		Material No.		434 208 029 0	
Date				Part Code		005	
Date				Language		M	
Date				Sheet		1/1	
Date				Function Code		00 X	
Date				ISO System		Pr/C	
Date				Part Type		0 0 X	
Date				Prepared by			

## Warranty

### 12 Month Limited Warranty

DC Electronics warrants to the consumer that all DC Electronics products will be free from defects in material and workmanship for a period of twelve months from the date of the original purchase. Products that fail within this 12-month warranty period will be repaired or replaced when determined by us that the product failed due to defects in material or workmanship. This warranty is limited to the repair or replacement of the DC Electronics part. This warranty applies only to the original purchaser of the product and is non-transferable. All implied warranties shall be limited in duration to the said 12-month warranty period. Improper use or installation, accident, abuse, unauthorized repairs, opening the casing or alterations performed by the user on any DC Electronics products voids this warranty.

In no event shall this warranty exceed the original purchase price of the DC Electronics part nor shall DC Electronics be responsible for special, incidental or consequential damages or cost incurred due to the failure of this product.

DC Electronics disclaims any liability for consequential damages due to breach of any written or implied warranty on all of its products.

Warranty returns will only be accepted by DC Electronics after email confirmation is given to return the product. The product must be received by DC Electronics within 30 days of the dated email and shipping is at the consumers expense. Once your package is received by our warranty and repairs department you will be notified and provided with updates.

In the case of Void warranty claims the consumer will be responsible for all shipping, duty and repair costs. The consumer will be notified of a void warranty claim before any repair work is undertaken.

### Intended Use And Safety Information

- All input pressure lines **MUST** be fitted with an air filter of at least 5 microns.
- Air supply must be in accordance with ISO 8573-1:2010 (7:4:4) and not exceed 10 bar.
- Temperature of the internal valve block should not exceed 70C/158F
- The units should be mounted using the supplied anti vibration mounds with the cover facing upwards.
- The BCU01 should be protected against water spray.
- **The BCU01 is specifically designed to work in conjunction with an external logic controller. This controller must be responsible for all decisions regarding the operation of the brakes and also for determining whether the BCU01 is operating within parameters or not. As the BCU is a universal product designed to work across multiple platforms, the BCU will report target and actual pressures via the CAN bus then the external logic controller using its own safety algorithms should take any remedial action required should the BCU01 not perform as expected.**
- **The BCU01 is designed with many redundant systems making it the ideal tool for autonomous research and development vehicles. Using the BCU01 on public roads is entirely at the risk of the consumer and great consideration should be given to ensure the adequate back up systems are in place to ensure safe operation of the vehicle.**



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