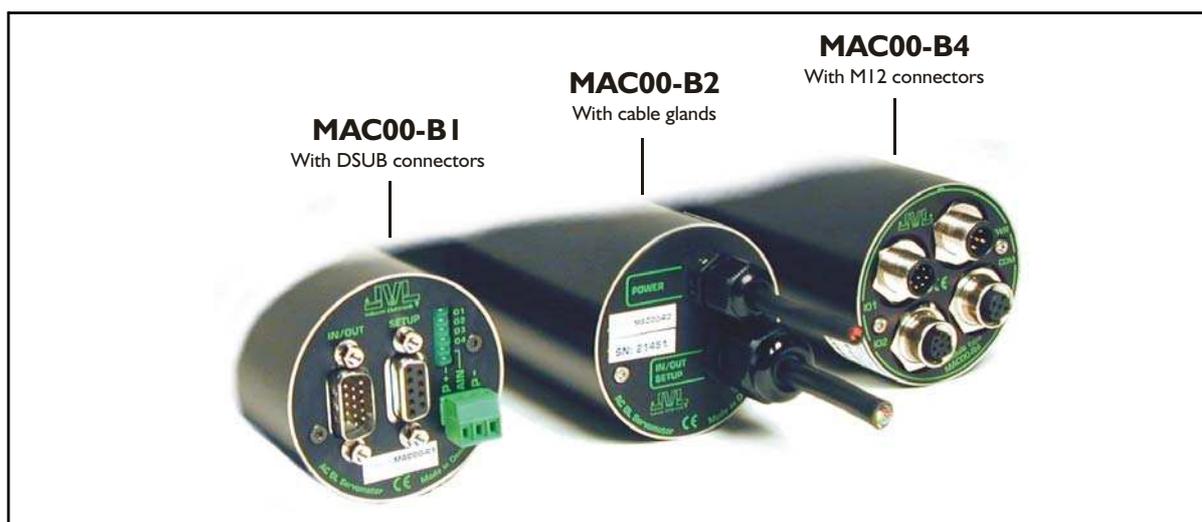


4.2 Expansion Modules MAC00-B1/B2/B4



4.2.1 Expansion modules MAC00-B1, B2 and B4 — overall description

The expansion modules MAC00-B1, B2 and B4 can be mounted in all the standard MAC motors up to MAC800. These modules are among the simplest and lowest cost modules in the product range. The modules contain no intelligence (microprocessor).

The MAC00-B1, B2 or B4 expansion module offers an industrial interface that mates with the standard MAC motor and offers a number of feature enhancements, including:

- Different kinds of connectors for more reliability (compared to the basic motor itself).
- Full RS232 protocol support for use with standard serial cable.
- Full RS485 protocol support for multipoint communication up to 100m.
- Sourcing (PNP) outputs for status signals O1 and O2 instead of sinking (NPN).
- Only MAC00-B1: LEDs to indicate: O1, O2 output status. Zero switch (analogue input) status and Input power status.
- Only MAC00-B2 and B4: Dual supply. The main supply can be removed but the control circuitry is kept active and position data and communication are still functional.

Typical applications for these expansion modules are:

- Closed loop systems with an overall controller involved.
- Replacement for pneumatic cylinders using the “Air Cylinder mode”
- Dispenser systems
- Simple velocity or torque control via +/-10V input.
- Machine adjustment/setup by sending RS232 or RS485 commands.

The B1, B2 and B4 are equivalent except for the following hardware differences:

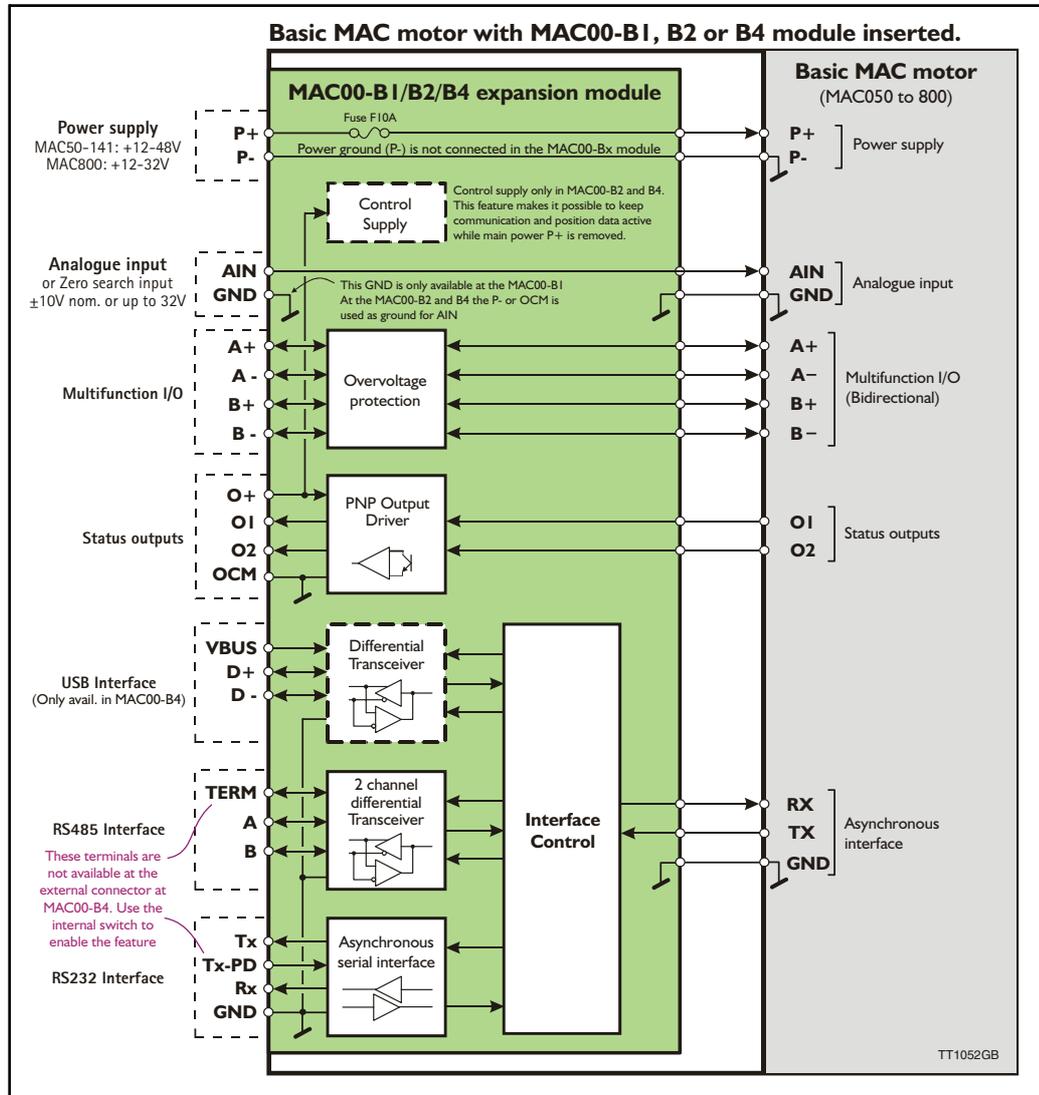
Type	Protection Class	Connectors			USB	Dual Supply
		I/O and interface	Power supply	LEDs at I/O		
MAC00-B1	IP42	DSUB 9 pole	3 pole Phoenix	Yes	No	No
MAC00-B2	IP67	Cable glands	Cable glands	No	No	Yes
MAC00-B4	IP67	M12	M12	No	Yes	Yes

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4.2 Expansion Modules MAC00-B1/B2/B4

4.2.2 General hardware aspects

All internal and external main connections can be seen in the illustration below. Please note that a few features are only available in MAC00-B4 and partly in B2.



4.2.3 General hardware description

The MAC00-B1, B2 and B4 modules offer the following external connections.

- **Power supply (P+/P-)**
These terminals are used for the main supply of the motor. A voltage between +12 and 48VDC (MAC50-141) and +12-32VDC (MAC800) must be connected.
- **Analogue input (AIN)**
The analogue input is used either as an analogue input or digital input. When used as an analogue input, it can control velocity, torque or position depending on which mode is set for motor operation. When used for digital input, it can be used in position-related modes for the external zero-search sensor. Also in "Air Cylinder Mode" the analogue input is used as a trigger input.
For a functional description, please refer to *Analogue input*, page 44.
(continued)

4.2 Expansion Modules MAC00-B1/B2/B4

- **Multifunction I/O (A+,A- , B+ and B-)**

The functionality of these terminals is the same as for the basic MAC motor. They can be set up in 3 different configurations.

 - Pulse inputs - for functional description please refer to *Multifunction I/O used as pulse inputs*, page 47 and *General description: "Multifunction I/O" when using a Bx module*, page 60
 - Pulse outputs - for functional description please refer to *Multifunction I/O used as pulse outputs*, page 48 and
 - RS422 interface - for functional description please refer to *Multifunction I/O used as serial communication interface*, page 49.

Important !:
Remember to configure "I/O type" as "Pulse Input" in MacTalk if none of the 4 terminals A+, A-, B+ and B- is used (the multifunction I/O's). This must be done to avoid random function of the motor since the multifunction I/Os are defined as "Serial data" as default.
- **Status outputs (O1, O2, O+, and OCM)**

The status outputs O1 and O2 (PNP outputs) indicate the actual status of the MAC motor.

 - O1** This output functions as an "In Position" or "at velocity" output depending on which operating mode is selected. The position interval can be set up using the MacTalk program.
 - O2** This output is normally passive but if a fatal error occurs, it will be activated to indicate that normal operation of the motor has been interrupted and no further operation is possible until a reset or power down has been made.
- **USB Interface (VBUS, D+, D- and GND)** - Only available in MAC00-B4
Serial interface for connection to a PC or a controller. The protocol is similar to the RS232 or RS485 interface, which means that all registers/parameters in the motor can be monitored or changed.
- **RS485 Interface (A-, B+ and GND)**
Serial balanced interface for connection to a PC or a controller. The protocol is similar to the RS232 or USB interface, which means that all registers/parameters in the motor can be monitored or changed. The RS485 is recommended for longer distances or in noisy environments.
- **RS232 Interface (Rx, Tx and GND)**
Serial unbalanced interface for connection to a PC or a controller. The protocol is similar to the USB or RS485 interface, which means that all registers/parameters in the motor can be monitored or changed. RS232 is not recommended for long distances (> 10m).

The MAC motor uses "binary" communication protocol which makes it possible to access all the internal registers. Please consult *Serial communication*, page 166 for further details.

4.2 Expansion Modules MAC00-B1/B2/B4

4.2.4 General power supply description

The power supply must be connected to the terminals marked P+ and P-.

MAC50, 95, 140 or 141:

A supply voltage in the range 12VDC to 48VDC can be used. However the maximum speed of the motor (4000 RPM) is based on 48VDC. A lower voltage will decrease the speed/torque performance, and in general it is not recommended to run the motor at more than 2000 RPM if, for example, 24VDC is used as the supply.

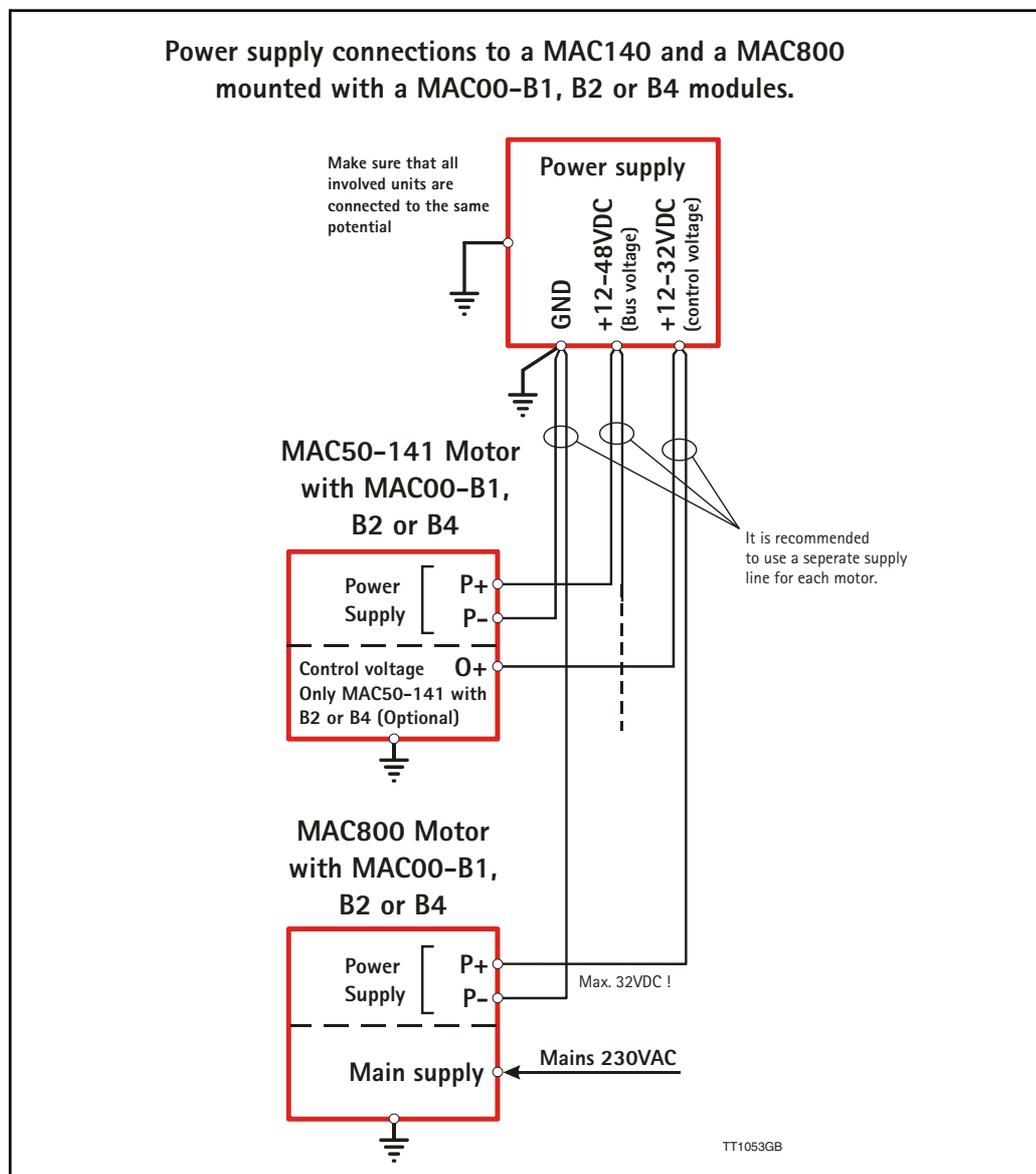
Optionally, the MAC00-B2 and B4 modules also offer a control voltage input (O+) which means that the internal control circuitry will be kept powered when the main supply (P+) is removed. See also the general power supply description *Power Supply*, page 37.

MAC800

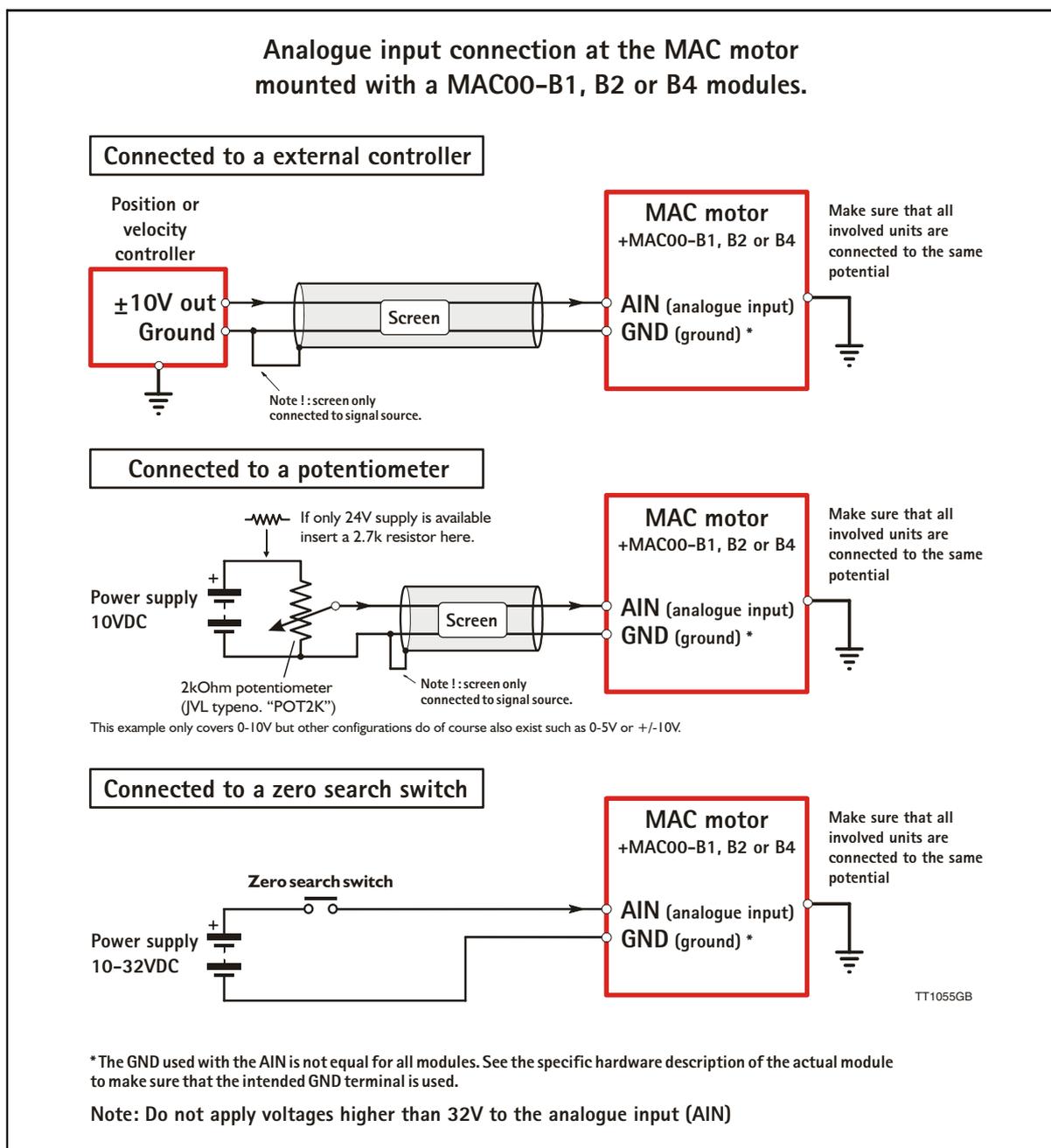
For the MAC800, the main supply is 115/230VAC connected at separate terminals.

The P+ power supply terminal only serves as a supply to the internal control circuitry.

The voltage must stay in the range +12-32VDC. See also the general power supply description *Power Supply*, page 37.



4.2 Expansion Modules MAC00-B1/B2/B4



4.2.5 General Analogue input (AIN) description when using MAC00-Bx

When a MAC00-B1, B2 or B4 module is mounted in the MAC motor, the analogue input is available in the same manner as in the basic motor itself.

The analogue input can be used for several applications and the function of the analogue input is determined by the mode in which the motor is set to operate.

Typically the input is used for controlling the velocity, torque or position of the motor but the input is also used as digital input for zero search or in "Air Cylinder Mode" where it is used as trigger input for the movement done by the motor.

For further information concerning physical connections, see the individual chapters for each module type: *General description MAC00-B1*, page 62, *General description MAC00-B2*, page 63, or *General description MAC00-B4*, page 65.

4.2 Expansion Modules MAC00-B1/B2/B4

4.2.6 RS232 - General description when using a MAC00-Bx module

The RS232 interface is considered the main interface to the motor when the motor is set up using the MacTalk windows software from a PC or from any kind of controller using a RS232 interface.

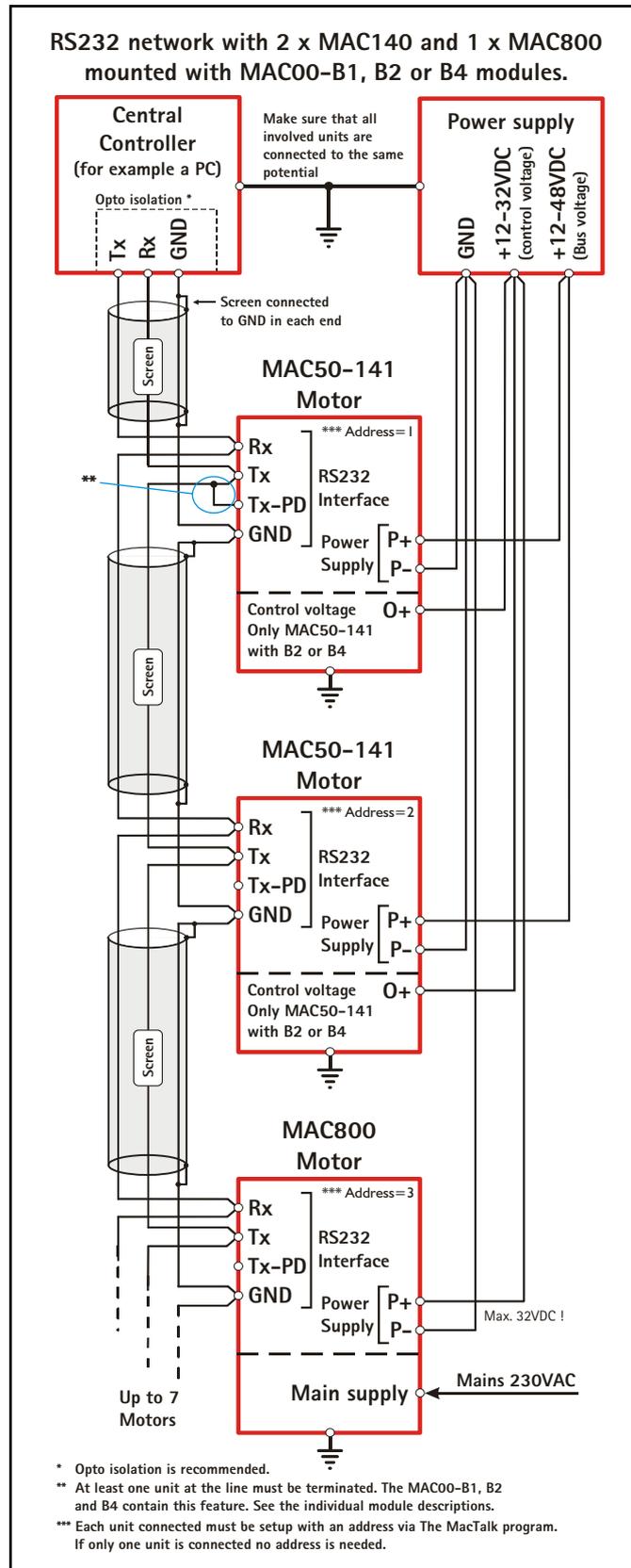
Note: The basic MAC motor does not fully support RS232 since the interface signals are only 5V levels. See also the basic description - Serial interface, page 43.

When connecting the RS232 interface to a PC or controller, the following rules must be followed:

- 1 Ensure that Tx-PD is connected to TX on one of the units in the system. Note that the B1, B2 and B4 modules all contain a termination resistor which can be activated.
- 2 Use screened cable.
- 3 Ensure that GND is also connected.
- 4 Ensure that all units have a proper connection to safety ground (earth) in order to refer to the same potential.
- 5 Ensure that the supply lines are connected individually in order to minimise the voltage drop between the motors.
- 6 Master Controller RS485 interface:
If available, it is strongly recommended a type with optical isolation is used.
- 7 The interface cable length should not exceed 10 metres.

Connectors:

Please read the individual description for the MAC00-B1, B2 or B4 to see the RS232 connector layout.



4.2 Expansion Modules MAC00-B1/B2/B4

4.2.7 RS485 - General description when using a MAC00-Bx module

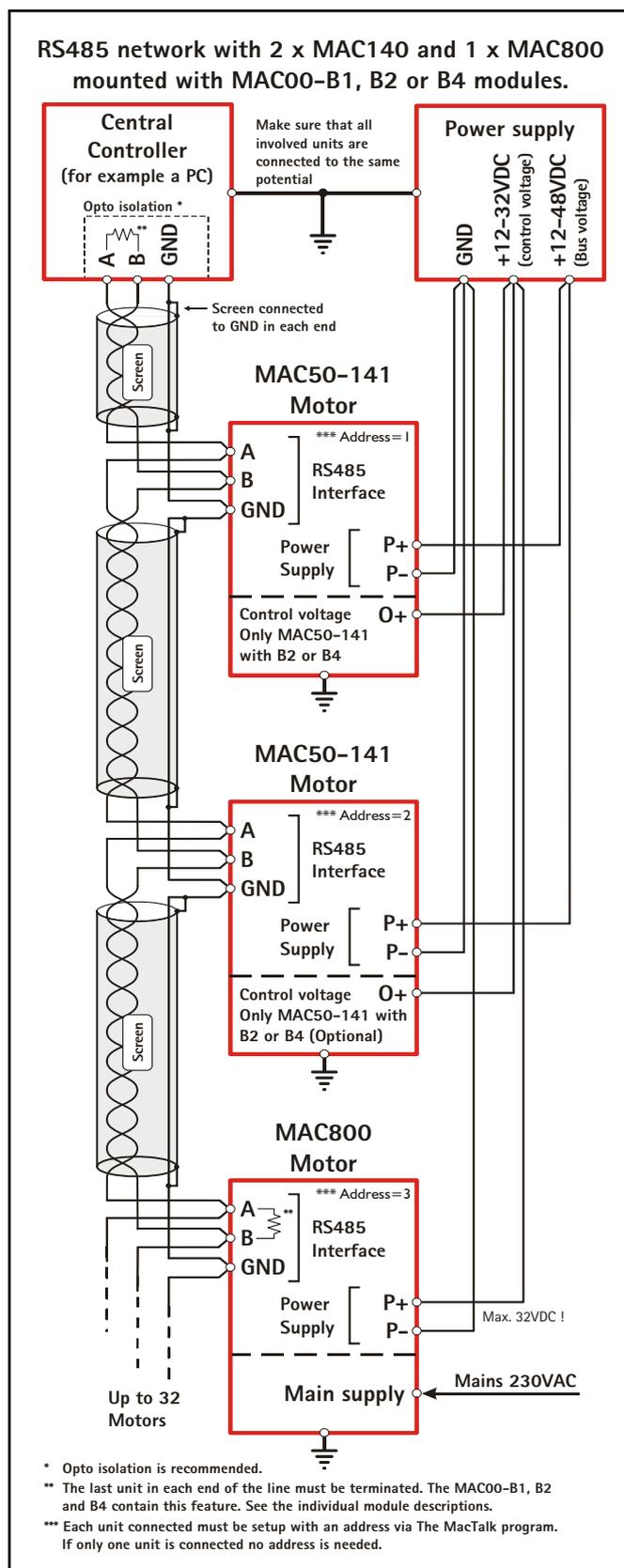
The RS485 offers more noise-immune communication compared to the RS232 interface. Up to 32 motors can be connected to the same line.

When connecting the RS485 interface to a central controller, the following rules must be followed:

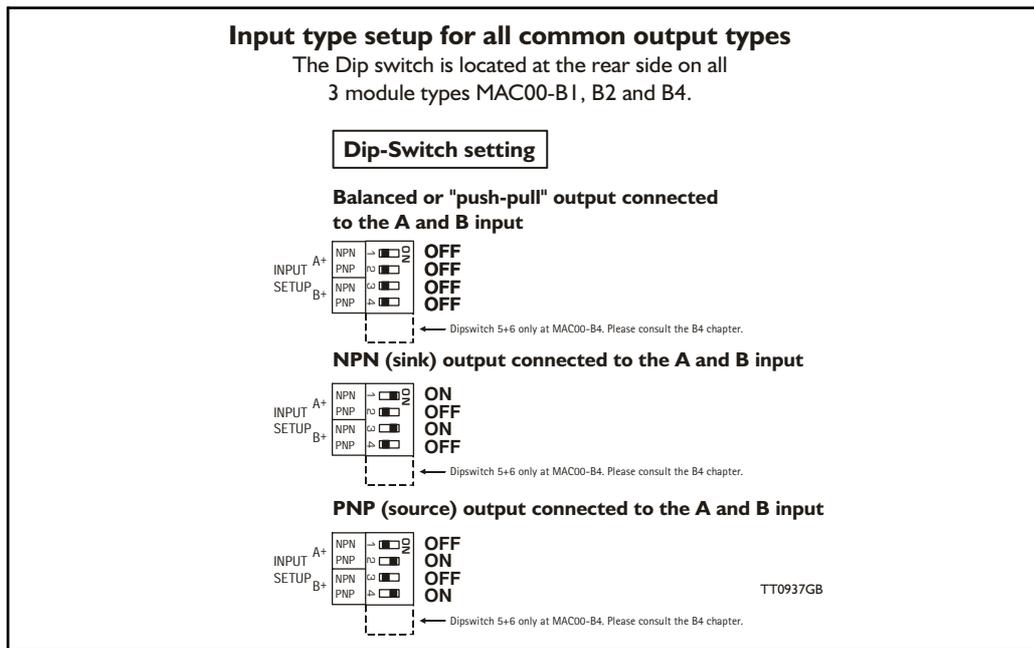
- 1 Use twisted-pair cable
- 2 Use screened cable
- 3 Ensure that GND is also connected.
- 4 Ensure that all units have a proper connection to safety ground (earth) in order to refer to the same potential.
- 5 The last unit in each end of the network must be terminated. Note that the B1, B2 and B4 modules all contain a termination resistor which can be activated.
- 6 Ensure that the supply lines are connected individually in order to minimise the voltage drop between the motors.
- 7 Master Controller RS485 interface:
If available, it is strongly recommended a type with optical isolation is used.

Connectors:

Please read the individual description for the MAC00-B1, B2 or B4 to see the connector layout.



4.2 Expansion Modules MAC00-B1/B2/B4



4.2.8 General description: "Multifunction I/O" when using a Bx module

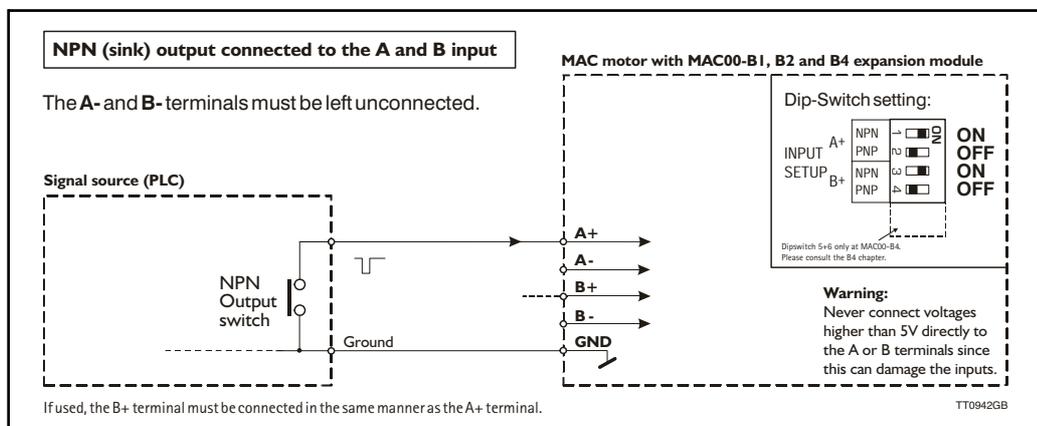
The function of the Multifunction I/O is equal to that of the basic motor with the exception that the B1, B2 or B4 modules include an overvoltage protection and a dip-switch to set up what kind of signal source feeds the input (if the Multifunction I/O is set up as inputs).

The illustration above shows how to set up the Multifunction I/O terminals as balanced/push pull, NPN or PNP input. The illustrations below show examples of connections for each of these signal types.

4.2.9 Connecting an NPN signal source to the Multifunction I/O

The drawing below shows how to connect an NPN source to the MAC00-B1, B2 or B4 multifunction I/Os. The diagram shows the A channel. The B channel must be connected in the same manner. Ensure that the A- and B- terminals are unconnected in order to maintain proper function.

Warning: Voltages higher than 5V must under no circumstance be connected directly to the input since this will damage the input permanently.



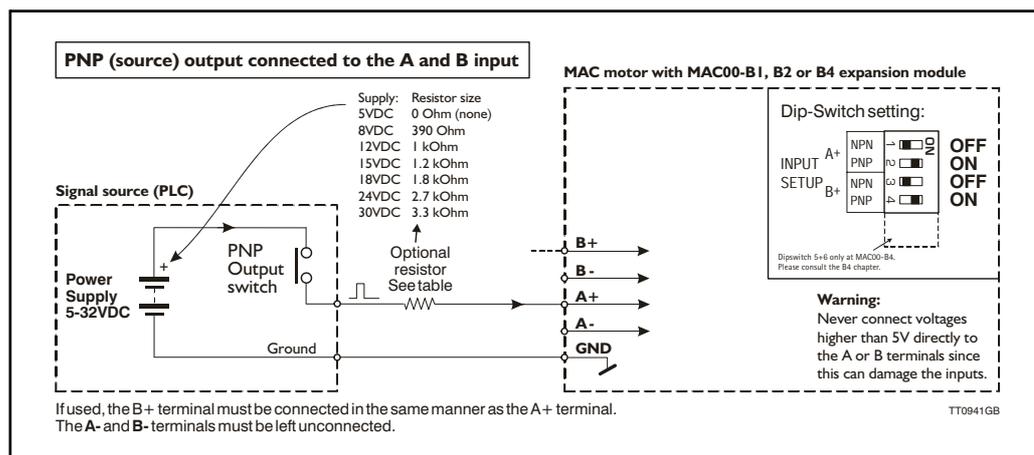
4.2 Expansion Modules MAC00-B1/B2/B4

4.2.10 Connecting a PNP signal source to the Multifunction I/O

The drawing below shows how to connect a PNP source to the MAC00-B1, B2 or B4 multifunction I/Os. The diagram shows the A channel. The B channel must be connected in the same manner.

Ensure that the A- and B- terminals are unconnected in order to maintain proper function.

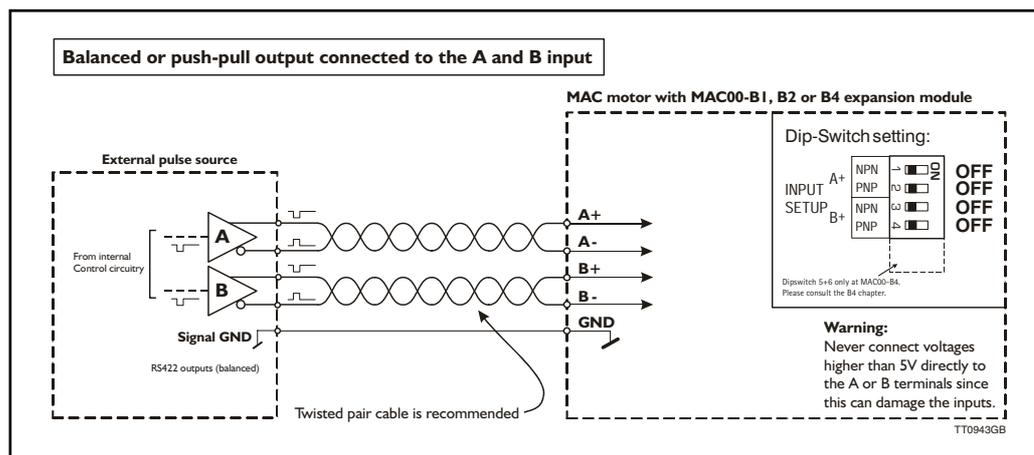
Warning: Voltages higher than 5V must under no circumstance be connected directly to the input since this will damage the input permanently. Use a proper resistor as indicated in the table below.



4.2.11 Connecting a balanced/push-pull signal to the Multifunction I/O

The drawing below shows how to connect a balanced or push-pull signal source to the MAC00-B1, B2 or B4 multifunction I/Os. Use twisted-pair cable for the balanced signals in order to ensure noise immunity.

Warning: Voltages higher than 5V must under no circumstance be connected directly to the input since this will damage the input permanently. Use a proper resistor as indicated in the table below.



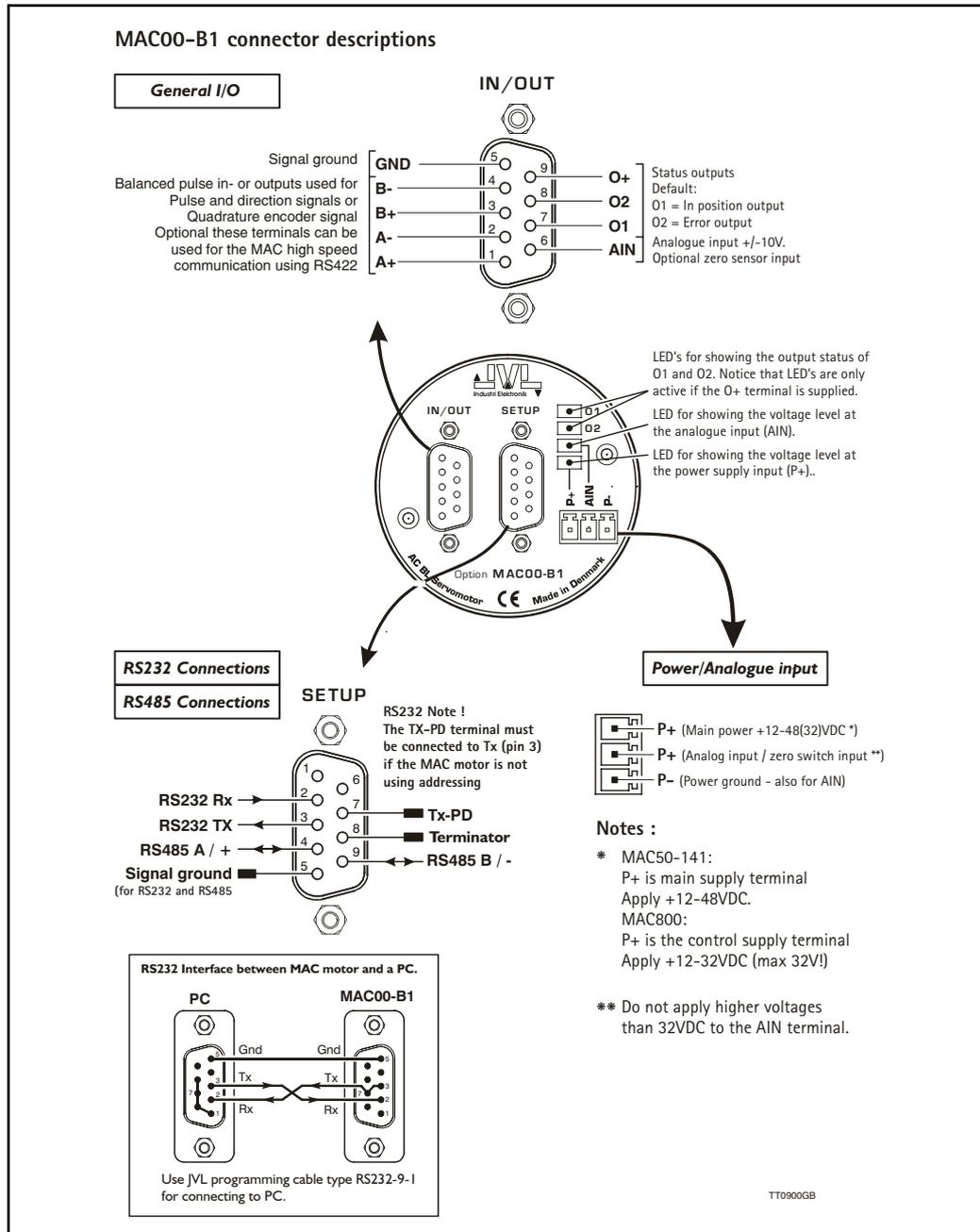
4.2 Expansion Modules MAC00-B1/B2/B4

4.2.12 General description MAC00-B1

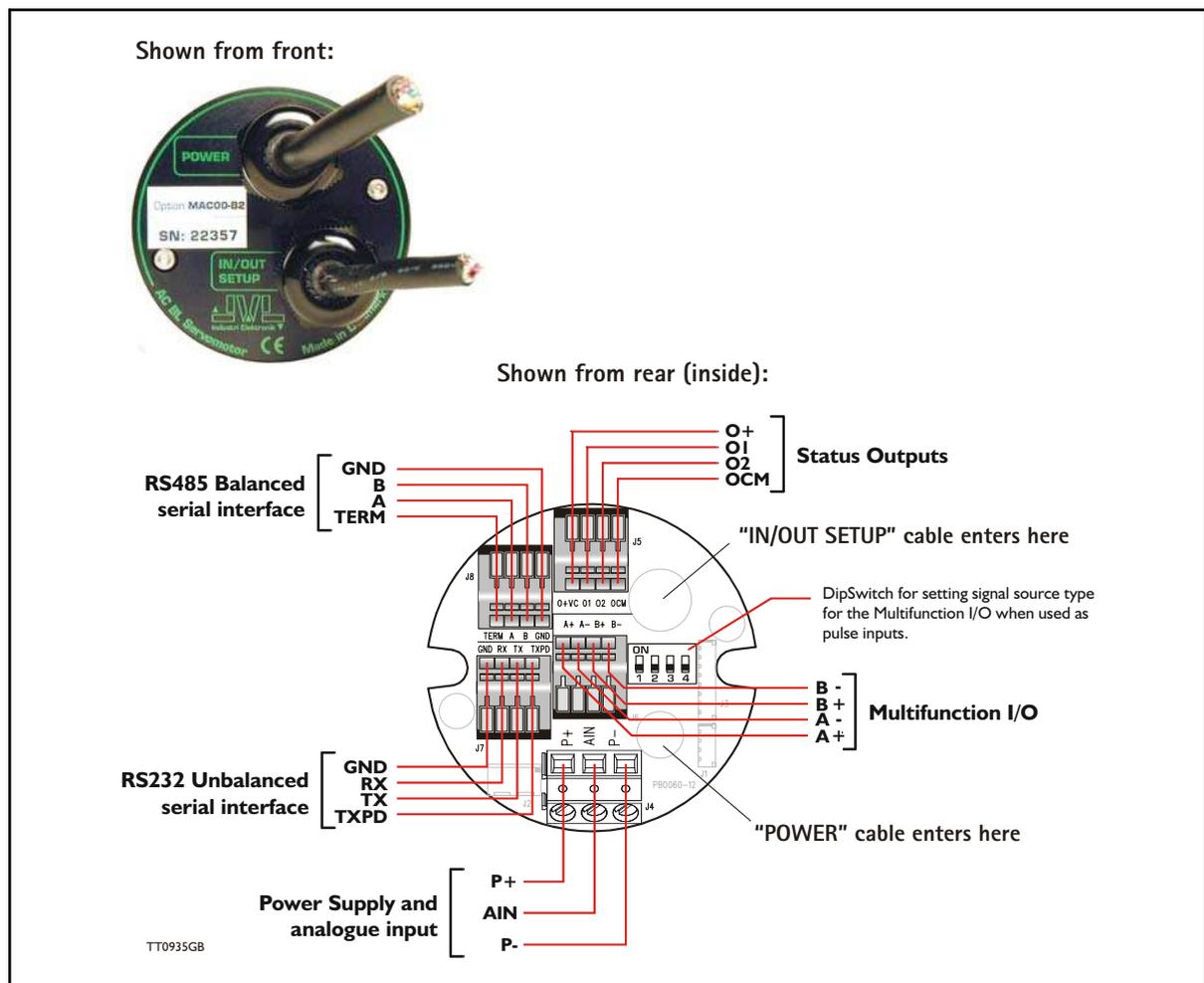
The MAC00-B1 expansion module is an industrial interface that mates with the standard MAC motor and offers a number of feature enhancements, including:

- Standard 9-pin D-SUB connectors for additional reliability.
- Addition of a Zero switch input for locating a mechanical zero point of the actuator when used in position-related modes.
- Pluggable screw terminal connector for power supply and Zero switch.
- LEDs to indicate: O1 and O2 output status, Zero switch (analogue input) status. Input power status.
- Full RS232 and RS485 protocol support for use with standard 9-pin DSUB.
- Sourcing (PNP) outputs for status signals O1 and O2 instead of sinking (NPN).

The following illustration shows all the connectors on the MAC00-B1 module.



4.2 Expansion Modules MAC00-B1/B2/B4



4.2.13 General description MAC00-B2

The MAC00-B2 expansion module is an industrial interface that mates with the standard MAC motors and offers a number of feature enhancements, including:

- IP67 protection if mounted on basic MAC motor with the IP67 option.
- Direct cable connection through sealed compression cable glands.
- Addition of a Zero switch input for locating a mechanical zero point of the actuator when used in position-related modes.
- Screw terminals (internal) for all signal lines, power supply and Zero switch.
- Full RS232 protocol support
Note: The basic MAC motor is only equipped with a low-voltage serial interface that requires the use of the RS232-9-1-MAC option cable which has integrated electronics to boost the voltage levels.
- Full RS485 protocol support for multipoint communication up to 100m.
- Sourcing (PNP) outputs for status signals O1 and O2. The basic MAC motors offers sinking (NPN).

4.2 Expansion Modules MAC00-B1/B2/B4

4.2.14 MAC00-B2 option with cables

The 'MAC00-B2' type number designation only covers the basic module without any cables.

If a number is added after the basic type number, for example MAC00-B2-10, this suffix indicates that the module is fitted with 2x10m of cable. One cable is used for the power supply and analogue input, and the other cable covers all the signal lines, i.e. RS232, RS485, status outputs and multifunction I/O. See the following tables.

Power cable (Cable 1) - Internal connector J4			
Signal name	Pin no.	Description	Wire colour
P-	3	Power supply ground	White
AIN	2	Analogue input (AIN)	Green
P+	1	Power supply +12-48VDC Nom.	Yellow / Brown

Signal cable (Cable 2) - Internal connectors J5-8			
Signal name	Pin no.	Description	Wire colour
O+	J5/1	Status Outputs. Positive supply - Max. 30VDC	Red
O1	J5/2	Status Outputs. Output 1 - PNP(sourcing) max. 25mA	Grey
O2	J5/3	Status Outputs. Output 2 - PNP(sourcing) max. 25mA	Pink
OCM	J5/4	Status Outputs. Output ground	Blue
B-	J6/1	Multifunction I/O. Terminal B-.	Brown/Green
B+	J6/2	Multifunction I/O. Terminal B+. Connect to ground (GND J7/4 or J8/4) if not used ***	White/Green
A-	J6/3	Multifunction I/O. Terminal A-.	Grey/Pink
A+	J6/4	Multifunction I/O. Terminal A+. Connect to ground (GND J7/4 or J8/4) if not used ***	Red/Blue
TXPD *	J7/1	RS232 Interface. Transmit pull-down (Connect to TX if addressing is not used).	Green
TX	J7/2	RS232 Interface. Transmit (Connect to TXPD if addressing is not used).	Yellow
RX	J7/3	RS232 Interface. Receive. Connect to ground if not used.	White
GND	J7/4	RS232 Interface. Ground for RS232	Brown
TERM **	J8/1	RS485 Interface. Terminator. Connect to "A" (J8/2) if MAC motor is the last node on the interface bus. Important: Do not connect if not used.	Purple
A	J8/2	RS485 Interface. A (positive) terminal. Important: Do not connect if not used.	Yellow/Brown
B	J8/3	RS485 Interface. B (negative) terminal Important: Do not connect if not used.	White/Yellow
GND	J8/4	RS485 Interface. Signal ground.	Black
Cable Screen			
The cable-screen is internally connected to motor housing. Externally it must be connected to earth.			

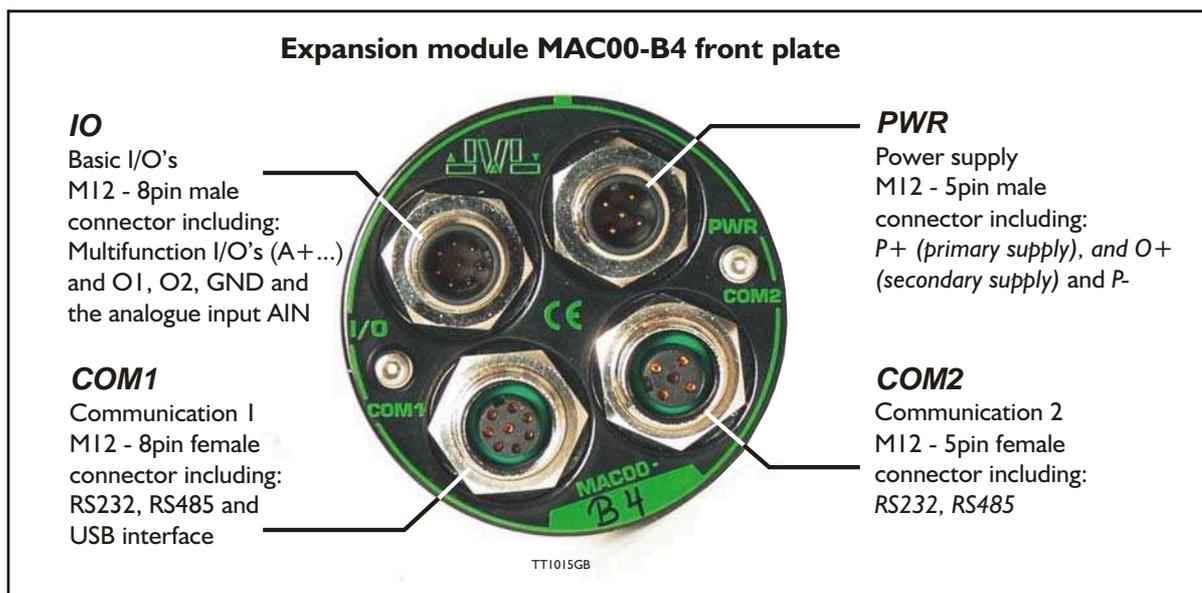
* Connect to the TX terminal if the module is the **only** or the **last** node on the line in order to terminate the line.

** Connect to the A terminal if the module is the **only** or the **last** node on the line in order to terminate the line.

*** Remember to configure "I/O type" as "Pulse Input" in MacTalk if none of the 4 terminals A+, A-, B+ and B- are used (the multifunction I/Os). This must be done to avoid random function of the motor since the multifunction I/Os are defined as "Serial data" by default.

Important: Please note that the cables are a standard type. They are not recommended for use in cable chains or where the cable is repeatedly bent. If this is required, use a special robot cable (2D or 3D cable).

4.2 Expansion Modules MAC00-B1/B2/B4



4.2.15 General description MAC00-B4

The MAC00-B4 expansion module is protection class IP67 and is basically similar to the B1 and B2 modules except that it offers M12 circular industrial connectors which makes the module flexible and robust.

Additional features are:

- Secondary power supply input which can be used to keep the control core alive during emergency situations
- The module contains a USB interface.
- Dual interface connectors make it easy to daisy chain with other motors at the RS232 or RS485 interface.

4.2.16 Expansion MAC00-B4 hardware description

The MAC00-B4 offers IP67 protection and M12 connectors which makes it ideal for automation applications where no additional protection is desired. The M12 connectors offer solid mechanical protection and are easy to unplug compared to the B2 module with cable glands.

The connector layout:

"PWR" - Power input. M12 - 5pin male connector				
Signal name	Description	Pin no.	JVL Cable W11000M12 F5A05N	Isolation group
P+	Main supply +12-48VDC. Connect with pin 2 *	1	Brown	1
P+	Main supply +12-48VDC. Connect with pin 1 *	2	White	1
P-	Main supply ground. Connect with pin 5 *	3	Blue	1
O+	Output supply / Control voltage +12-30VDC.	4	Black	1
P-	Main supply ground. Connect with pin 3 *	5	Grey	1

* Note: P+ and P- are each available at 2 terminals. Make sure that both terminals are connected in order to split the supply current in 2 terminals and thereby avoid an overload of the connector.

(Continued next page)

4.2 Expansion Modules MAC00-B1/B2/B4

"IO" - Basic I/O's. M12 - 8pin male connector.				
Signal name	Description	Pin no.	JVL Cable WI1000-M12 F8A05N	Isolation group
A+	Multifunction I/O terminal A+	1	White	1
A-	Multifunction I/O terminal A-	2	Brown	1
B+	Multifunction I/O terminal B+	3	Green	1
B-	Multifunction I/O terminal B-	4	Yellow	1
O1	Digital output 1 - PNP output	5	Grey	1
O2	Digital output 2 - PNP output	6	Pink	1
OCM	Ground intended to be used together with the other signals in this connector.	7	Blue	1
AIN	Analogue input +/- 10V or used for zero search	8	Red	1
"COM1" - Communication connector 1. M12 - 8pin female connector.				
Signal name	Description	Pin no.	JVL Cable WI1000-M12 M8A05N	Isolation group
USB: D-	USB interface. Negative terminal	1	White	1
RS232: TX	RS232 interface. Transmit terminal Leave open if unused.	2	Brown	1
RS232: RX	RS232 interface. Receive terminal Leave open if unused.	3	Green	1
GND	Ground intended to be used together with the other signals in this connector,	4	Yellow	1
RS485: B+	RS485 interface. Leave open if unused	5	Grey	1
RS485: A-	RS485 interface. Leave open if unused	6	Pink	1
USB: D+	USB interface. Positive terminal	7	Blue	1
USB: VBUS	USB interface. Sense input for the bus supply	8	Red	1
"COM2" - Communication connector 2. M12 - 5pin female connector				
Signal name	Description	Pin no.	JVL Cable WI1000M12 M5A05N	Isolation group
RS232 Rx	RS232 interface receive terminal. Leave open if unused	1	Brown	1
RS232 Tx	RS232 interface transmit terminal. Leave open if unused	2	White	1
RS485 B+	RS485 interface. Leave open if unused	3	Blue	1
RS485 A-	RS485 interface. Leave open if unused	4	Black	1
GND	Interface ground (same as main ground).	5	Grey	1

4.2 Expansion Modules MAC00-B1/B2/B4

4.2.17 MAC00-B4 dip-switch setup

The 6 pole dip-switch is placed on the rear side of the MAC00-B4 module. The following illustration shows how to set up the switch.

MAC00-B4 Dip switch settings

Main fuse 10Amp.
 Replace only with:
 Schurter type
 "3402.0040.11"
 or
 Littlefuse type
 "451-10A"

Mini dip-switch
OFF ← ON

Dip-Switch for
Input type setup
Dip 5 - RS232 TxPD
Dip 6 - RS485 Term.
SWI

Rear side of the MAC00-B4
expansion module

TT1031GB

Default switch setting:
 As shown above. Dip 1-6 = OFF, ON, OFF, ON, ON, OFF
 - Input A and B is setup for PNP outputs.
 - RS232 TxPD (Transmit pull-down) is enabled.
 - RS485 Termination is disabled.

Input type setup (only switch 1-4)

Balanced or "push-pull" output connected to the A and B input

<p>SWI</p>	<p>NPN (sink) output connected to the A and B input</p> <p>SWI</p>	<p>PNP (source) output connected to the A and B input</p> <p>SWI</p>
------------	---	---

RS232 TxPD setup (only switch 5)

One of the motors connected to an RS232 line must have this switch set to "ON" but only at one !.

SWI

RS485 Term. setup (only switch 6)

The last motors connected to an RS485 line must have this switch set to "ON" but only at one !.

SWI

4.2 Expansion Modules MAC00-B1/B2/B4

4.2.18 Cables for the MAC00-B4

The following cables equipped with M12 connector can be supplied by JVL.

MAC00-B4 Connectors				Description	JVL Order no.	Picture
“IO” 8pin Male	“COM1” 8pin Female	“COM2” 5pin Female	“PWR” 5pin Male			
		X		RS232 Interface cable. Connects directly from MAC00-R4 to PC Length: 5m (197 inch)	RS232-M12-1-5	
			X	Cable with M12 female 5 pin 90 degree connector, loose ends. Length: 5m (197 inch)	WI1000-M12F5A05N	
			X	Same as above but 20m (787 inch)	WI1000-M12F5A20N	
		X		Cable with M12 male 5 pin 90 degree connector, loose ends. See also type <i>RS232-M12-1-5</i> .	WI1000-M12M5A05N	
		X		Same as above but 20m (787 inch)	WI1000-M12M5A20N	
X				Cable with M12 female 8pin 90 degree connector, loose ends.	WI1000-M12F8A05N	
X				Same as above but 20m (787 inch)	WI1000-M12F8A20N	
	X			Cable with M12 male 8pin 90 degree connector, loose ends.	WI1000-M12M8A05N	
	X			Same as above but 20m (787 inch)	WI1000-M12M8A20N	
Protection caps. Optional if connector is not used to protect from dust / liquids.						
	X	X		IP67 protection cap for M12 female connector.	WI1000-M12FCAP1	
X			X	IP67 protection cap for M12 male connector.	WI1000-M12MCAP1	

Important: Please note that the cables are a standard type. They are not recommended for use in cable chains or where the cable is repeatedly bent. If this is required, use a special robot cable (2D or 3D cable).

4.3 Expansion Modules MAC00-FC2/FC4



4.3.1 CAN-Open Introduction

The MAC00-FC2 and FC4 expansion modules are CAN-Open slaves. With these modules, all of the registers in the MAC motor can be accessed over a CAN-Open network. The modules implement an object dictionary that follows the CiA DS-301 standard. The modules contain a number of static mapped PDOs that can be used to access the most common registers. The MAC00-FC2 and FC4 also support the DSP-402 standard from CiA.

Expansion modules MAC00-FC2 and FC4 can be mounted on the standard MAC motors MAC50, MAC95, MAC140, MAC141, MAC400 and MAC800.

Both modules offer the same functionality but with the following hardware differences:

Type	Protection class	Connectors		
		I/O and interface	Power supply	Bus interface
MAC00-FC2	IP67	Cable glands (Mini crimp connectors internally)	Cable glands (Screw terminals internally)	Cable glands x 2 (Screw terminals internally)
MAC00-FC4	IP67	M12	M12	M12 (x2)

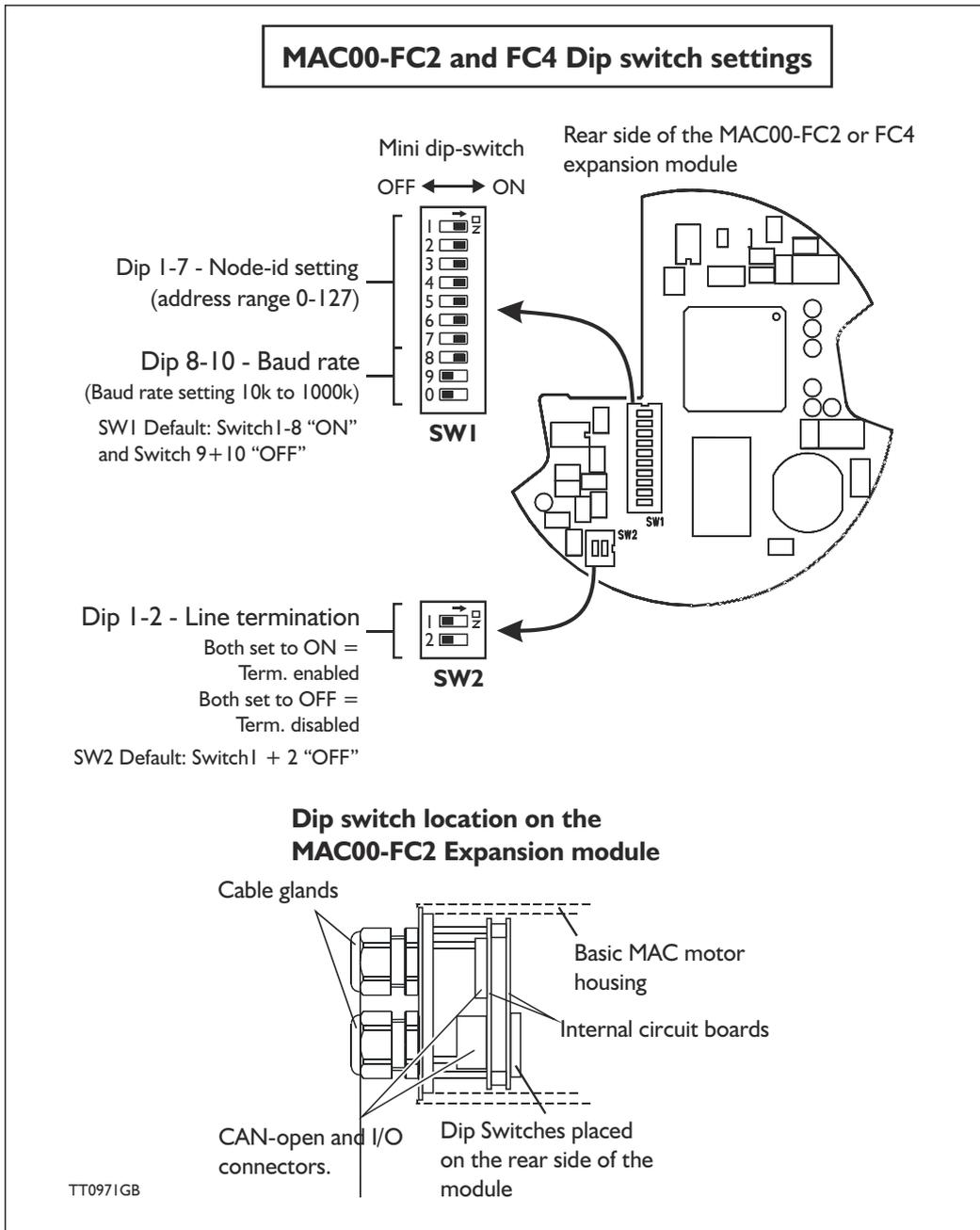
The MAC00-FC2 module can also be delivered with cable in selected lengths. Cables with M12 connectors can also be supplied for the MAC00-FC4 module.

The pages in the first part of this section concern the common features of both modules. Please see the last pages of this section to see specific information about each module (for example connection diagrams).

4.3 Expansion Modules MAC00-FC2/FC4

4.3.2 Node-ID, Baud Rate and Termination setup

The 10-way dip switch (SW1) is used to select the node ID and the baud rate. Switches 1-7 select the node ID, and switches 8-10 select the baud rate. The 2-way dip switch (SW2) is used to enable termination. When both switches are on, the termination is enabled.



4.3 Expansion Modules MAC00-FC2/FC4

The address can be set according to the following table:

Node-id	Dip Switch no. (SW1)							Node-id	Dip Switch no. (SW1)						
	7	6	5	4	3	2	1		7	6	5	4	3	2	1
0	Reserved (illegal setting)							32	OFF	ON	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	OFF	ON	33	OFF	ON	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	OFF	ON	OFF	34	OFF	ON	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	OFF	OFF	ON	ON	35	OFF	ON	OFF	OFF	OFF	ON	ON
4	OFF	OFF	OFF	OFF	ON	OFF	OFF	36	OFF	ON	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	OFF	OFF	ON	OFF	ON	37	OFF	ON	OFF	OFF	ON	OFF	ON
6	OFF	OFF	OFF	OFF	ON	ON	OFF	38	OFF	ON	OFF	OFF	ON	ON	OFF
7	OFF	OFF	OFF	OFF	ON	ON	ON	39	OFF	ON	OFF	OFF	ON	ON	ON
8	OFF	OFF	OFF	ON	OFF	OFF	OFF	40	OFF	ON	OFF	ON	OFF	OFF	OFF
9	OFF	OFF	OFF	ON	OFF	OFF	ON	41	OFF	ON	OFF	ON	OFF	OFF	ON
10	OFF	OFF	OFF	ON	OFF	ON	OFF	42	OFF	ON	OFF	ON	OFF	ON	OFF
11	OFF	OFF	OFF	ON	OFF	ON	ON	43	OFF	ON	OFF	ON	OFF	ON	ON
12	OFF	OFF	OFF	ON	ON	OFF	OFF	44	OFF	ON	OFF	ON	ON	OFF	OFF
13	OFF	OFF	OFF	ON	ON	OFF	ON	45	OFF	ON	OFF	ON	ON	OFF	ON
14	OFF	OFF	OFF	ON	ON	ON	OFF	46	OFF	ON	OFF	ON	ON	ON	OFF
15	OFF	OFF	OFF	ON	ON	ON	ON	47	OFF	ON	OFF	ON	ON	ON	ON
16	OFF	OFF	ON	OFF	OFF	OFF	OFF	48	OFF	ON	ON	OFF	OFF	OFF	OFF
17	OFF	OFF	ON	OFF	OFF	OFF	ON	49	OFF	ON	ON	OFF	OFF	OFF	ON
18	OFF	OFF	ON	OFF	OFF	ON	OFF	50	OFF	ON	ON	OFF	OFF	ON	OFF
19	OFF	OFF	ON	OFF	OFF	ON	ON	51	OFF	ON	ON	OFF	OFF	ON	ON
20	OFF	OFF	ON	OFF	ON	OFF	OFF	52	OFF	ON	ON	OFF	ON	OFF	OFF
21	OFF	OFF	ON	OFF	ON	OFF	ON	53	OFF	ON	ON	OFF	ON	OFF	ON
22	OFF	OFF	ON	OFF	ON	ON	OFF	54	OFF	ON	ON	OFF	ON	ON	OFF
23	OFF	OFF	ON	OFF	ON	ON	ON	55	OFF	ON	ON	OFF	ON	ON	ON
24	OFF	OFF	ON	ON	OFF	OFF	OFF	56	OFF	ON	ON	ON	OFF	OFF	OFF
25	OFF	OFF	ON	ON	OFF	OFF	ON	57	OFF	ON	ON	ON	OFF	OFF	ON
26	OFF	OFF	ON	ON	OFF	ON	OFF	58	OFF	ON	ON	ON	OFF	ON	OFF
27	OFF	OFF	ON	ON	OFF	ON	ON	59	OFF	ON	ON	ON	OFF	ON	ON
28	OFF	OFF	ON	ON	ON	OFF	OFF	60	OFF	ON	ON	ON	ON	OFF	OFF
29	OFF	OFF	ON	ON	ON	OFF	ON	61	OFF	ON	ON	ON	ON	OFF	ON
30	OFF	OFF	ON	ON	ON	ON	OFF	62	OFF	ON	ON	ON	ON	ON	OFF
31	OFF	OFF	ON	ON	ON	ON	ON	63	OFF	ON	ON	ON	ON	ON	ON

Table continued on next page

4.3 Expansion Modules MAC00-FC2/FC4

Address table continued from previous page:

Node-id	Dip Switch no. (SW1)							Node-id	Dip Switch no. (SW1)						
	7	6	5	4	3	2	1		7	6	5	4	3	2	1
64	ON	OFF	OFF	OFF	OFF	OFF	OFF	96	ON	ON	OFF	OFF	OFF	OFF	OFF
65	ON	OFF	OFF	OFF	OFF	OFF	ON	97	ON	ON	OFF	OFF	OFF	OFF	ON
66	ON	OFF	OFF	OFF	OFF	ON	OFF	98	ON	ON	OFF	OFF	OFF	ON	OFF
67	ON	OFF	OFF	OFF	OFF	ON	ON	99	ON	ON	OFF	OFF	OFF	ON	ON
68	ON	OFF	OFF	OFF	ON	OFF	OFF	100	ON	ON	OFF	OFF	ON	OFF	OFF
69	ON	OFF	OFF	OFF	ON	OFF	ON	101	ON	ON	OFF	OFF	ON	OFF	ON
70	ON	OFF	OFF	OFF	ON	ON	OFF	102	ON	ON	OFF	OFF	ON	ON	OFF
71	ON	OFF	OFF	OFF	ON	ON	ON	103	ON	ON	OFF	OFF	ON	ON	ON
72	ON	OFF	OFF	ON	OFF	OFF	OFF	104	ON	ON	OFF	ON	OFF	OFF	OFF
73	ON	OFF	OFF	ON	OFF	OFF	ON	105	ON	ON	OFF	ON	OFF	OFF	ON
74	ON	OFF	OFF	ON	OFF	ON	OFF	106	ON	ON	OFF	ON	OFF	ON	OFF
75	ON	OFF	OFF	ON	OFF	ON	ON	107	ON	ON	OFF	ON	OFF	ON	ON
76	ON	OFF	OFF	ON	ON	OFF	OFF	108	ON	ON	OFF	ON	ON	OFF	OFF
77	ON	OFF	OFF	ON	ON	OFF	ON	109	ON	ON	OFF	ON	ON	OFF	ON
78	ON	OFF	OFF	ON	ON	ON	OFF	110	ON	ON	OFF	ON	ON	ON	OFF
79	ON	OFF	OFF	ON	ON	ON	ON	111	ON	ON	OFF	ON	ON	ON	ON
80	ON	OFF	ON	OFF	OFF	OFF	OFF	112	ON	ON	ON	OFF	OFF	OFF	OFF
81	ON	OFF	ON	OFF	OFF	OFF	ON	113	ON	ON	ON	OFF	OFF	OFF	ON
82	ON	OFF	ON	OFF	OFF	ON	OFF	114	ON	ON	ON	OFF	OFF	ON	OFF
83	ON	OFF	ON	OFF	OFF	ON	ON	115	ON	ON	ON	OFF	OFF	ON	ON
84	ON	OFF	ON	OFF	ON	OFF	OFF	116	ON	ON	ON	OFF	ON	OFF	OFF
85	ON	OFF	ON	OFF	ON	OFF	ON	117	ON	ON	ON	OFF	ON	OFF	ON
86	ON	OFF	ON	OFF	ON	ON	OFF	118	ON	ON	ON	OFF	ON	ON	OFF
87	ON	OFF	ON	OFF	ON	ON	ON	119	ON	ON	ON	OFF	ON	ON	ON
88	ON	OFF	ON	ON	OFF	OFF	OFF	120	ON	ON	ON	ON	OFF	OFF	OFF
89	ON	OFF	ON	ON	OFF	OFF	ON	121	ON	ON	ON	ON	OFF	OFF	ON
90	ON	OFF	ON	ON	OFF	ON	OFF	122	ON	ON	ON	ON	OFF	ON	OFF
91	ON	OFF	ON	ON	OFF	ON	ON	123	ON	ON	ON	ON	OFF	ON	ON
92	ON	OFF	ON	ON	ON	OFF	OFF	124	ON	ON	ON	ON	ON	OFF	OFF
93	ON	OFF	ON	ON	ON	OFF	ON	125	ON	ON	ON	ON	ON	OFF	ON
94	ON	OFF	ON	ON	ON	ON	OFF	126	ON	ON	ON	ON	ON	ON	OFF
95	ON	OFF	ON	ON	ON	ON	ON	127	Node id will be the same as for the motor						

If the node-id is set to 127, the node address will be set to the same as the motor address (can be defined in MacTalk).

4.3 Expansion Modules MAC00-FC2/FC4

The baud rate can be set according to the following table:

Baud rate	Dip Switch no. (SW1)		
	10	9	8
1000 kbit	OFF	OFF	OFF
500 kbit	OFF	OFF	ON
250 kbit	OFF	ON	OFF
125 kbit	OFF	ON	ON
100 kbit	ON	OFF	OFF
50 kbit	ON	OFF	ON
20 kbit	ON	ON	OFF
10 kbit	ON	ON	ON

4.3.3 Object dictionary

	Index (hex)	Sub Index	Type	Read only	Default	Description
Command	2010	0	UNSIGNED8			Execute a MAC00-FCx command
Module parameters	2011	0	UNSIGNED8	X	7	Subindex count
		1	UNSIGNED8	X		Input status IN1 - IN4, NL, PL
		2	UNSIGNED8			Output
		3	UNSIGNED8	X		Motor Status
		4	UNSIGNED16	X		Last Motor Error
		5	UNSIGNED8			Output setup
		6	UNSIGNED8			Input active level
		7	UNSIGNED8			Input setup
Motor parameters	2012	0	UNSIGNED8	X	254	Subindex count
		n	UNSIGNED32			Access to the motor parameter n
FastMac Command	2013	0	UNSIGNED8			Executes a FastMac command
DSP-402	2100	0	UNSIGNED16		1000	Defines the torque limit used during homing with DSP-402

4.3 Expansion Modules MAC00-FC2/FC4

4.3.4 Object 2010h

When writing to this object (sub index 0), it is possible to execute some special commands for the MAC00-FCx module.

The following commands are available:

Number	Function
0	No operation
1	Reset limit error
2	Reset communication error
3-255	Reserved

4.3.5 Object 2011h - Subindex 1 Input status

This object is used to read out the actual value of the inputs.

Bit	7	6	5	4	3	2	1	0
Input	Reserved		PL	NL	IN4	IN3	IN2	IN1

4.3.6 Object 2011h - Subindex 2 Outputs

With this object the outputs can be controlled.

The value written to this object is directly shown on the outputs if the output is not set to use its default function (see subindex 5).

Bit	7	6	5	4	3	2	1	0
Output	Reserved						O2	O1

4.3.7 Object 2011h - Subindex 3 Motor status

With this object the status of the motor can be monitored.

Bit	7	6	5	4	3	2	1	0
Data	Reserved	Deceleration	Acceleration	In position	Reserved	Limit switch Error	Disconnected	Motor Error

Bit 6: Equals 1, if the velocity is decreasing.

Bit 5: Equals 1, if the velocity is increasing.

Bit 4: Equals 1, if the motor is at the commanded position.

Bit 2: Equals 1, if a limit switch has been activated.

Bit 1: Equals 1, if there is a communication error between the MAC00-FC and the motor. This could occur if the motor has been reset due to a voltage drop.

Bit 0: Equals 1, if there is a fatal motor error. Read subindex 4 to get extended information.