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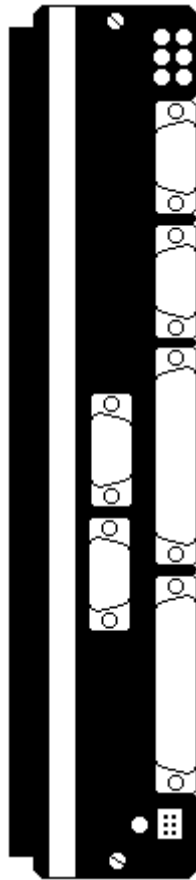
OPERATING MANUAL

SERIES SMTBD1

DIGITAL BRUSHLESS POSITIONER

(Version 3.0)

European version 1.3



This is a general manual describing a series of servo amplifiers having the capability for driving AC Brushless servo motors. It concerns only the basic amplifier version SMT-BD1. This manual may be used in conjunction with appropriate and referenced drawings pertaining to the various specific models.

Maintenance procedures should be attempted only by highly skilled technicians (EN 60204.1 standard) using proper test equipment. Read your warranty provision carefully before attempting to adjust or service the unit.

RECEIVING AND HANDLING

Upon delivery of the equipment, inspect the shipping containers and contents for indications of damages incurred in transit. If any of the items specified in the bill of lading are damaged, or the quantity is incorrect, do not accept them until the freight or express agent makes an appropriate notation on your freight bill or express receipt.

Claims for loss or damage in shipment must not be deducted from your invoice, nor should payment be withheld pending adjustment of any such claims.

Store the equipment in a clean, dry area. It is advisable to leave the equipment in its shipping container until ready for use. Each amplifier is checked carefully before shipment. However, upon receipt, the user should make sure that the amplifier received corresponds to or is properly rated in terms of rated voltage and current for the type of motor which is to be driven. The descriptive label affixed to the amplifier specifies electrical ratings.

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OPERATING MANUAL
INFRANOR
SERIES SMTBD1
“POSITIONER”
(July 1999)

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1.0.0 GENERAL

1.1.0 Introduction

Series SMT-BD1/m servo modules are PWM servo amplifiers that provide position control for AC sinusoidal motors (brushless) with transmitter resolver.

The pluggable SMT-BD1/m system is available as a single-axis block version or as a multi-axis version that can receive up to six axes in a standard 19" rack.

The SMT-BD1/m servo amplifier can operate independently or in connection with a PLC (or a PC). It generates the positioning trajectory itself. After programming, the amplifier is waiting for the START signal or a serial link command before starting the program.

1.2.0 General description

The SMT-BD1/m servo modules have their own DC/DC converter to provide appropriate logic voltage to the modules. This power supply can use, as a source, either the 310 V_{DC} bus power voltage or an auxiliary supply which is necessary particularly when the position output information needs to be saved.

Each module is packaged as 6U "double Eurocard": one power board with IGBT transistors and one logic board with DSP (Digital Signal Processing).

The SMT-BD1/m amplifier directly controls the motor torque, speed and position by means of the information provided by a transmitter resolver sensor.

All control parameters are programmable by means of a serial RS 232 link and saved in a single EEPROM in the amplifier. The auto-configuration and auto-tuning functions allow quick and easy commissioning of the amplifier.

2.0.0 SPECIFICATIONS

2.1.0 Technical specifications

Operating voltage	DC bus 310 VDC (270 V < DC bus < 340 VDC)
Auxiliary supply voltage	310 VDC (200 V < Uaux < 340 VDC)
Motor phase-phase output voltage	200 Vrms for DC bus 310 V

Output currents for the **Fusing mode** of the I²t protection (see chapter 8.3.3)

AMPLIFIER	U rated (Vrms)	Imax (A rms) 1 s	Amplifier max. rated current (Arms)		
			WITHOUT FAN*	FAN TYPE 1*	FAN TYPE 2*
SMT-BD1 - 220/04	240	4,4	2		
SMT-BD1 - 220/08	240	8,8	4		
SMT-BD1 - 220/12	240	13,8	6		
SMT-BD1 - 220/17	240	17,7	8,5		
SMT-BD1 - 220/30	240	30,8	10	12	15
SMT-BD1 - 220/30r	240	30,8	10	15	
SMT-BD1 - 220/45	240	48,6	10	15	20
SMT-BD1 - 220/45r	240	48,6	10	20	23
SMT-BD1 - 220/60	240	61	10	19	25
SMT-BD1 - 220/60r	240	61	12	26	30
SMT-BD1 - 220/70	240	70	25	30	35
SMT-BD1 - 220/100	240	100	25	30	35

Output currents for the **Limiting mode** of the I²t protection (see chapter 8.3.3)

AMPLIFIER	U rated (Vrms)	Imax (Arms) 1 s	Amplifier continuous current (Arms)		
			WITHOUT FAN*	FAN TYPE 1*	FAN TYPE 2*
SMT-BD1 - 220/04	240	4,4	2		
SMT-BD1 - 220/08	240	8,8	4		
SMT-BD1 - 220/12	240	13,8	6		
SMT-BD1 - 220/17	240	17,7	8,5	8,5	
SMT-BD1 - 220/30	240	30,8	8,5	12	15
SMT-BD1 - 220/30r	240	30,8	10	15	
SMT-BD1 - 220/45	240	48,6	8,5	15	18
SMT-BD1 - 220/45r	240	48,6	10	20	23
SMT-BD1 - 220/60	240	61	8,5	17	20
SMT-BD1 - 220/60r	240	61	12	26	30
SMT-BD1 - 220/70	240	70	17	30	35
SMT-BD1 - 220/100	240	100	25	30	35

* Maximum ambient temperature = + 40° C, fan 1 = 56 l/s, fan 2 = 90 l/s.

Note: SMT-BD1-X/Xr amplifiers are equipped with an additional heatsink in order to increase the rated current. The width of these amplifiers is then 18 TE instead of 12 TE.

PWM Switching frequency	10 KHz
Minimum inductance between phases	1 mH
Current regulator (PI)	adjusted to motor
Current loop bandwidth	Cut-off frequency for 45° phase shift: > 1 KHz
Current limitation	Imax : 20% to 100% Icont : 20% to 100% Imax duration : 1 second for Icont = Imax/2
Speed regulator PI ²	Sampling period = 500us Integrator anti-saturation system Adjustable numerical gains
Speed loop bandwidth	Cut-off frequency for 45° phase shift Programmable : 50 Hz, 75 Hz or 100 Hz
Max. motor speed	Adjustable from 100 rpm to 14000 rpm
Encoder position output *	Quadrature output A and B channels with n marker pulse(s) per revolution. Programmable resolution: max. 8192 ppr up to 900 rpm max. 4096 ppr up to 3600 rpm max. 1024 ppr up to 14000 rpm Accuracy: 8 arc minutes + ¼ point (2 arc minutes + ¼ point on special request)
Analog outputs	Speed input command : ±10V for max speed Speed monitor: ±8 V for ±14000 rpm, linearity : 10% Current input command (IDC) : ±10V for max current resolution 8bits Current monitor (Imes): ± 10 V for max current resolution 8 bits
Logic inputs	Enable / Disable: ENABLE Positive limit switch +: FC+ Negative limit switch -: FC- Indexing input: INDEX Runing input: RUN
Optocoupled logic inputs	START, STOP, CLR, WAIT, TEACH, JOG+, JOG- IN1 to IN8
Logic outputs	Relay contact Umax = 60 V, Imax = 200 mA, Pmax = 10 W • "Amp ready": closed if amplifier OK, open if default • "Brake control": closed if brake, open if no brake
Optocoupled logic outputs	SEQ, POS, SPEED, OK, OUT1 to OUT8
Fault display	LED's on front panel and diagnostic via serial link
Motor and application parameter setting	Serial link RS232 (standard)
Automatic functions (AUTOPHASING)	Amplifier adjustment to the motor

(AUTOTUNING)

Index search (HOME)

Electromagnetic compatibility
Conducted and radiated disturbances
Electrical standards for industrial machines

IEC standards 801- 2 - 3 - 4, level 4
EN 5011 Group 1, class A
EN 60204.1: 1500 VAC - 1min insulation
Current leakage >3mA (EMI filters)

Temperature

storage - 20° C to + 70° C
operation 0° C to +40° C
altitude: 1000 m (3300 feet)
moisture: < 50 % at 40°C and < 90 % at 20°C
(EN 60204.1 standard)

Cooling

Natural convection or forced air, according to the
rated current (see current table)

- The total position accuracy must take into account the accuracy of the resolver used

2.1.1 Standard compatibility

SMT-BD1 amplifiers operating either in the RBF rack equipped with the mains filter BF-35/70, or the SMTBM-20A single axis and BF-35, have been approved for their conformity with the Electromagnetic Compatibility standards:

- EN 55011, Group 1, Class A (conducted and radiated radioelectric disturbances)
- IEC 801 - 2 - 3 - 4 (noise immunity).

Results and test conditions of the LCIE (Laboratories Central des Industries Electriques), which is approved by the European Community, are referenced with n° 416040, 416041, 416042, and 416043.

Results of the tests made according to the Low Voltage directive is referenced in the LCIE report n° 413777.

Standard to be applied to electrical equipment of industrial machines: EN 60204.1.

2.1.2 "CE" Marking

CE recognition marking has been affixed since 1995.

2.2.0 Main protections

2.2.1 Stored protections

PROTECTION	ERROR DISPLAY	LED*
Amplifier rated current overload #: <ul style="list-style-type: none"> flashing display = Idyn signal (I²t threshold is reached) continuous display = amplifier inhibited (I²t default) 	I ² t	● ○ ○ ○
Position following error	Position	○ ○ ○ ●
Resolver cable interruption	Resolver	○ ● ○ ○
Power stage failure: <ul style="list-style-type: none"> power supply overvoltage internal switch protection short-circuit between phases 	Power stage	● ● ○ ○
Resolver converter failure	R. D. C	○ ○ ● ○
Amplifier overtemperature	°C Amp	● ○ ● ○
Power supply undervoltage	Undervolt.	○ ● ● ○
Motor overtemperature	°C Motor	● ● ● ○
Default of the amplifier parameter storage	NovRAM	● ○ ● ●
Amplifier automatic procedure: <ul style="list-style-type: none"> flashing display = procedure operating continuous display = operating error 	Busy	● ● ● ●

The operation mode of the I²t protection is described in chapter 8.3.3.

* ○ = LED is unlit; ● = LED is lit.

Reset of a stored default can be made:

- by means of the RESET function in the BPCW software
- via the default RESET input (pin 13 of the X4 connector)
- by switching off the amplifier power supply.

2.2.2 Fuse protections

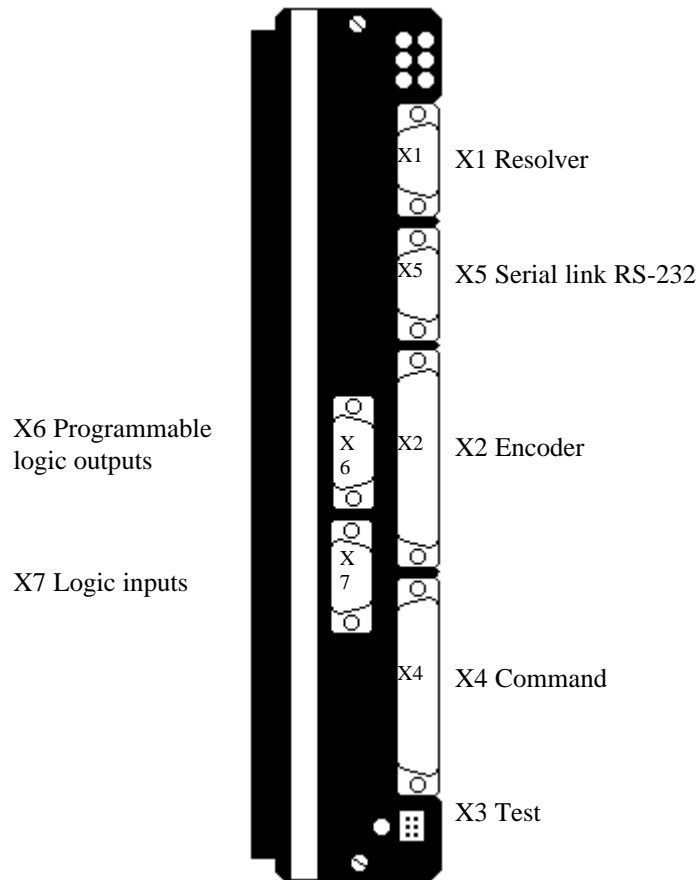
F1 : Control of average DC current of the power board supply.

F2 : Control of average DC current of the logic board supply.

AMPLIFIER TYPE	F1 Power	F2 Logic
SMTBD1-220/04 to 12	10 AT	1 A
SMTBD1-220/17 to 30	15 AT	1 A
SMTBD1-220/45	20 AT	1 A
SMTBD1-220/60	20 AT	1 A
SMTBD1-220/70	40 AT	5 AT
SMTBD1-220/100	40 AT	5 AT

3.0.0 INPUTS / OUTPUTS

3.1.0 Connector locations



3.2.0 X1 resolver connector (Sub-D 9 points female)

PIN	FUNCTION	REMARKS
1	TC (pin H sensor connector)	If thermal switch connected to X1
6	Shield connection	If no "360°" connection on the connector
2	TC (pin I sensor connector)	If thermal switch connected to X1
7	S1 (pin C sensor connector)	MAVILOR motor with resolver
3	S3 (pin D sensor connector)	MAVILOR motor with resolver
8	S4 (pin B sensor connector)	MAVILOR motor with resolver
4	S2 (pin A sensor connector)	MAVILOR motor with resolver
9	R2 (pin F sensor connector)	MAVILOR motor with resolver
5	R1 (pin E sensor connector)	MAVILOR motor with resolver

For resolver connections other than the MAVILOR motors, see resolver wiring table in chapter 10.2.0

3.3.0 X2 position connector (Sub-D 25 points female)

PIN	FUNCTION	I/O	REMARKS
1	Marker Z/	O	Differential output of the encoder marker pulse (5 V, 20 mA max.)
2	Marker Z	O	Differential output of the encoder marker pulse
3	Channel A/	O	Differential output of the encoder channel A/ (5 V, 20 mA max.)
4	Channel A	O	Differential output of the encoder channel A
5	Channel B/	O	Differential output of the encoder channel B/ (5 V, 20 mA max.)
6	Channel B	O	Differential output of the encoder channel B
7,10,11	0 V		
14	START	I	Optocoupled logic input
15	STOP	I	Optocoupled logic input
16	WAIT	I	Optocoupled logic input
17	TEACH	I	Optocoupled logic input
24	5 V		5 V/200mA jumper must be closed (between X2 and X5)
8	JOG +	I	Optocoupled logic input
18	JOG -	I	Optocoupled logic input
9	SEQ	O	Optocoupled logic output
20	POS	O	Optocoupled logic output
21	SPEED	O	Optocoupled logic output
22	OK	O	Optocoupled logic output
23	GND (24V)		24 V external ground
12	+24 V	I	24 V external supply for optocoupled logic outputs. This input must be used only if one of the output SEQ, SPEED, POS or OK are used and if the OUT1 to OUT8 outputs are not wired
15	GND		

3.4.0 X3 test connector

PIN	FUNCTION	REMARKS
1 - 6	0 Volt	
2	Current input command I DC	± 10 V; resolution: 8 bits, linearity 10% (DAC out 1)*
3	Speed input command CV	± 10 V for ± max. speed
4	Speed monitor GT	± 8 V for ± 14000 rpm
5	Current monitor I mes	± 10 V; resolution: 8 bits, linearity 10% (DAC out 2)*

* 10V for amplifier maximum current

3.5.0 X4 input - output command connector (Sub-D 25 points male)

PIN	FUNCTION	I/O	REMARKS
1	Limit switch +	I	Positive or negative logic
14	Limit switch -	I	Positive or negative logic
24	0V limit switch	I	
20	ENABLE	I	Positive or negative logic
23	0 V ENABLE	I	
4	RUN	I	Positive or negative logic
7	INDEX / CLR	I	Positive or negative logic
25	0 V logic input		
13	RESET	I	Amplifier reset (contact between pins 13 and 12)
12	0V RESET	I	
15	reserved		
16	0 V analog input command	I	
17	Optional analogue input	I	Speed reduction option. 0 to 10 V input (0V = max. speed 10V = min speed)
3	reserved		
10	Speed monitor output	O	
2	Current monitor output	O	
11	0 Volt analog output	O	
18,19	Amplifier ready	O	Relay contact, closed when amplifier OK Pmax = 10 W with Umax = 60 V or Imax = 200 mA
8, 9	Brake control output	O	Relay contact. Pmax = 10 W with Umax = 60 V or Imax = 200 mA
21	+15 Volts	O	Max. 50 mA
22	-15 Volts	O	Max. 50 mA
5, 6	not connected		

3.6.0 X5 serial link (Sub-D 9 points male)

PIN	FUNCTION	REMARKS
5	0 Volt	GND (connection of the shield if no "360°" connection on the connector)
2	TXD	Transmit data RS 232
3	RXD	Receive data RS 232
6	TXH	Transmit data RS422/485
7	TXL	Transmit data RS422/485
8	RXL	Receive data RS422/485
9	RXH	Receive data RS422/485

3.7.0 X6 Logic outputs (Sub-D 9 points female)

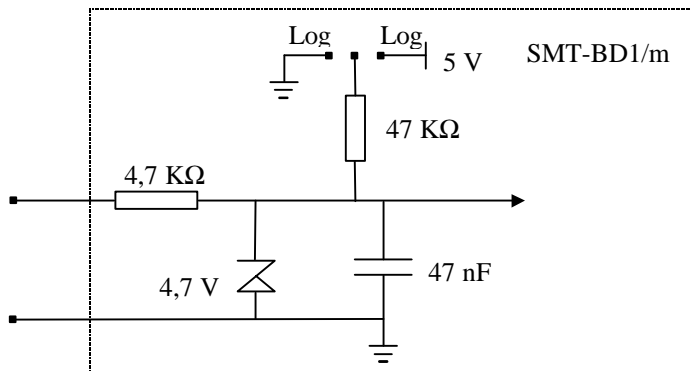
Pin	FUNCTION	REMARKS
1	OUT1	Programmable output n° 1
2	OUT2	Programmable output n° 2
3	OUT3	Programmable output n° 3
4	OUT4	Programmable output n° 4
5	OUT5	Programmable output n° 5
6	OUT6	Programmable output n° 6
7	OUT7	Programmable output n° 7
8	OUT8	Programmable output n° 8
9	24 V	24V external supply for optocoupled logic outputs. Must be used if one of the OUT1 to OUT8 outputs are used

3.8.0 X7 Logic inputs (Sub-D 9 points male)

Pin	FUNCTION	REMARKS
1	IN1	Logic input n° 1
2	IN2	Logic input n° 2
3	IN3	Logic input n° 3
4	IN4	Logic input n° 4
5	IN5	Logic input n° 5
6	IN6	Logic input n° 6
7	IN7	Logic input n° 7
8	IN8	Logic input n° 8
9	GND 24V	24 V external ground

3.9.0 Logic inputs/outputs specification

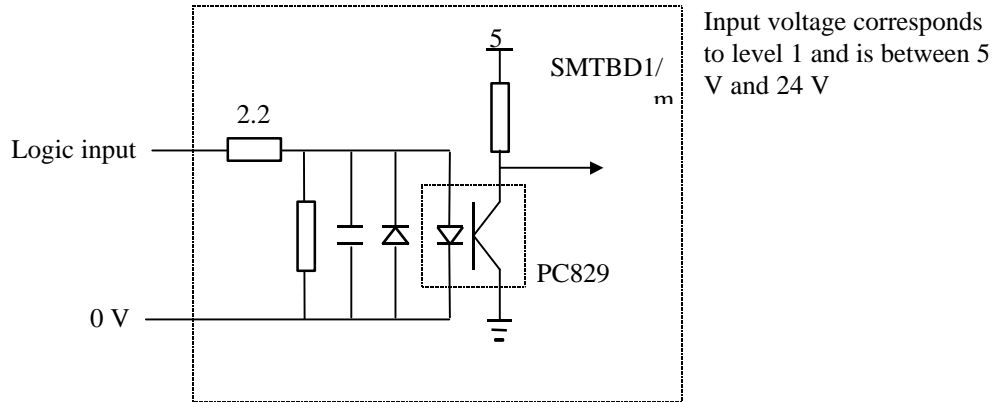
Optocoupled logic inputs: FC+, FC-, INDEX, RUN and ENABLE



Input impedance: 4.7 kΩ
Response time: 500 μs

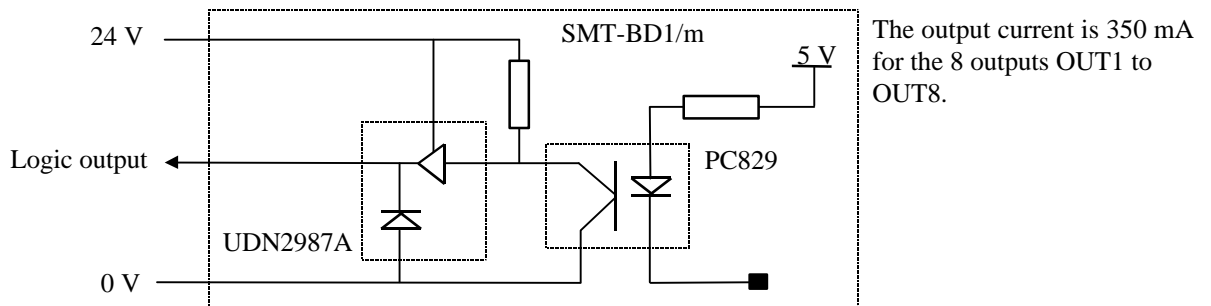
These inputs can be configured in positive or negative logic by means of jumpers (see section 10.4.1 "Positive or negative logic inputs")

Logic inputs START, STOP, CLR, WAIT, TEACH, JOG+, JOG-, IN1 to IN8



The polarity of these inputs can be reversed by software (see section 7.6.0 "Inputs - outputs configuration").

Logic outputs SEQ, POS, SPEED, OK, OUT0 to OUT8



The polarity of these inputs can be reversed by software (see section 7.6.0 "Inputs - outputs configuration").



Caution note

Should it be necessary to connect outputs in parallel, it is necessary to use diodes to prevent a short circuit.



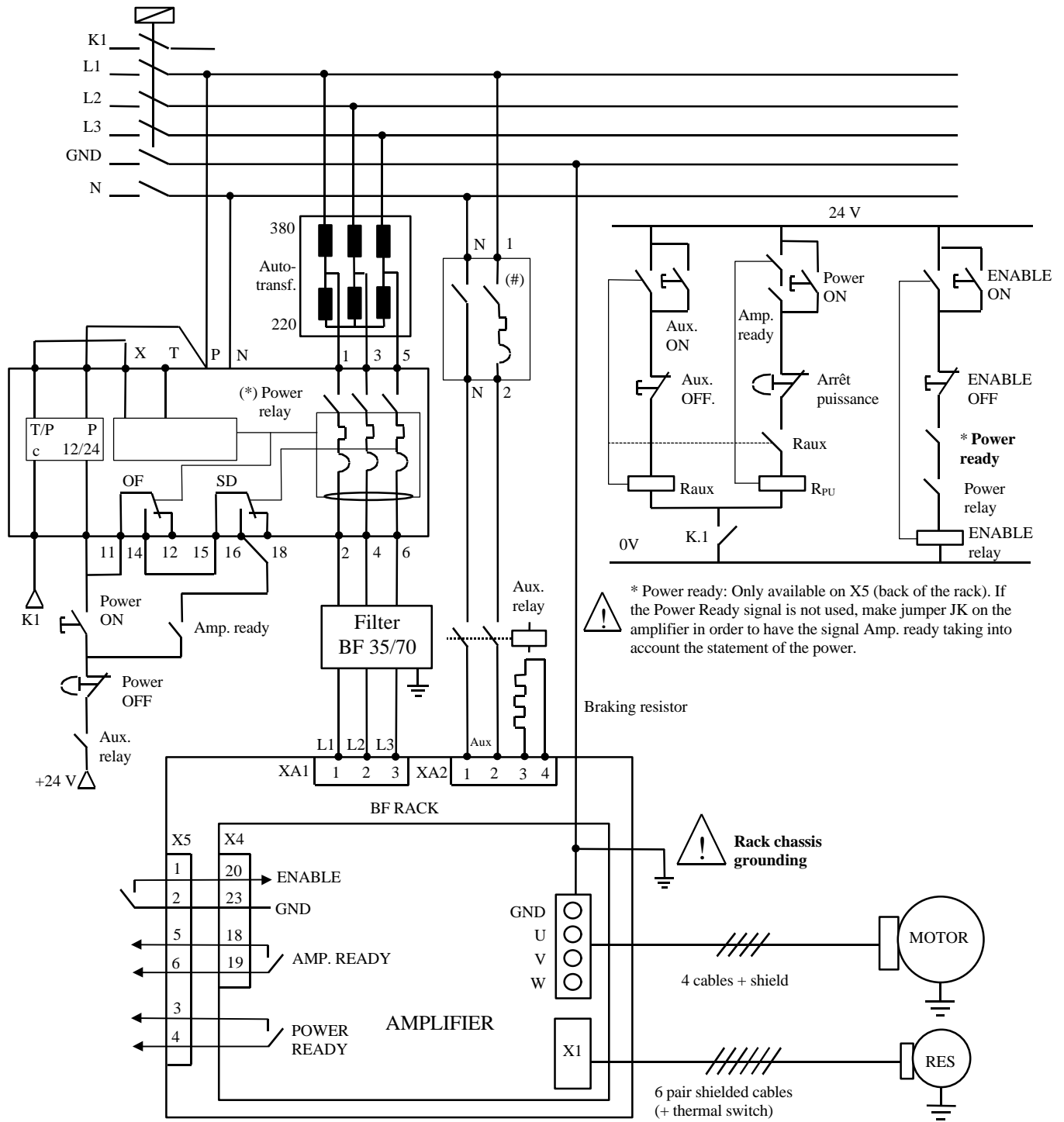
Caution note

If the 24 V remains on when the amplifier is off, the logic outputs SEQ, POS, SPEED, OK, OUT1 to OUT8 will be at a 24V potential.

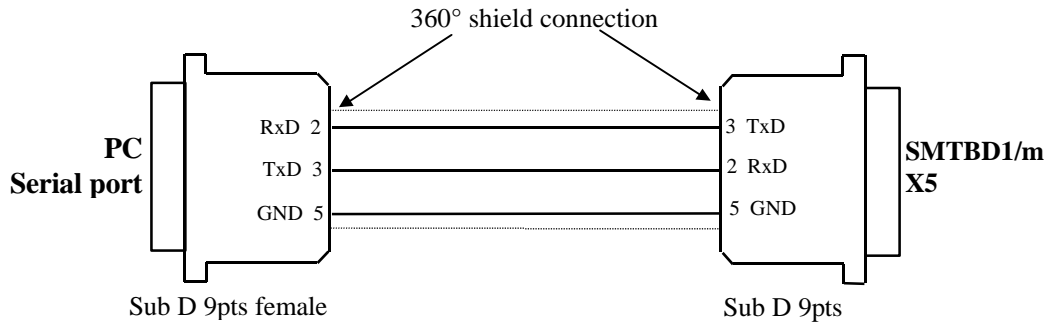
4.0.0 CONNECTIONS

4.1.0 Connection diagrams

4.1.1 Power connection with the RBF rack or the SMTBM-20A single axis module



4.1.2 Serial link connection



4.2.0 Wiring recommendation (according to IEC 801 and EN 55011 standards)

4.2.1 GND wiring and grounding

The reference potential is the **earth (ground)**. Motors and resolvers are grounded via their housing. If a reference of potential exists, like a main chassis or a cabinet, with a low impedance between the different elements, it should be used to connect ALL references to it and also connect this reference to the earth (ground).

Long reference potential connections are suitable ONLY if these connections have very low impedance ($< 0.1\Omega$).

Cables with low potential must NEVER run in the proximity of power lines.

Each conductor cable (carrying a potential) must be shielded. Several wires in the same sleeve must be twisted and shielded.

According to the IEC 801 standard, the connectors must be metallic or metal plated and must have a 360° shield connection (see chapter 8.6.0).

4.2.2 Motor and resolver cables

Cable ends should have a metallic collar allowing a 360° shielded connection.

Motor cables (four wires) must be shielded to avoid common mode effects (Mavilor p/n 410-0051, 410-0052, Belden p/n 9367).

The recommended resolver cable is a three pair twisted with an individual shield on each pair (Mavilor p/n 410-0053, Belden p/n 9728, Oflex p/n 34252).

4.2.3 Serial link cables

The serial link signal requires a twisted and shielded pair cable. The shield must have a "360°" connection via metallic collars at both ends. If the shield is connected by means of a pig tail, it must be connected at one end to a 0 Volt pin of X5 on the amplifier side with a connection as short as possible.

Logic 0 Volt is directly connected to the amplifier housing. The connection continuity is ensured by the fastening screws on the front panels. The amplifier 0 Volt and the controller 0 Volt MUST be connected by means of a wire. The shield MUST NEVER be used as a conductor of the 0 Volt potential.

Caution note

The serial link cable as well as the power cables MUST only be connected and/or disconnected with the amplifier TURNED OFF.

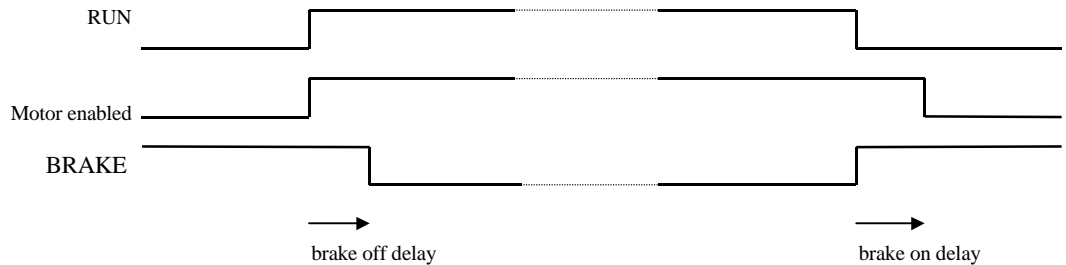
5.0.0 FUNCTIONAL FEATURES

5.1.0 Input logic description

ENABLE Enabling authorized. This input will enable the amplifier (see also signal RUN).

RUN Enabling signal.

The motor can be enabled only when the signals **ENABLE** and **RUN** are activated. Use only the RUN signal if using the brake control.

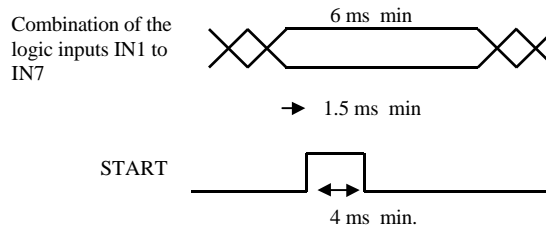


INDEX/CLR Index input for the axis origin search. This input can be used for resetting the position counter.

FC+ Limit switch input, positive direction.

FC- Limit switch input, negative direction.

START This signal starts the sequence which numbers are defined by the inputs IN1 to IN7. This signal must be disabled before the sequence is over.



STOP This input stops the motor with the programmed deceleration.

CLR This input resets the position counter when this function is configured.

WAIT When this signal is activated, it inhibits the execution of a sequence. The sequence will start when this signal is disabled.

TEACH This input allows to read the value of the current motor position and to program the sequence defined by the logic inputs (IN1 to IN7) with this value. If the sequence contains an index search procedure (HOME), this function has no effect.

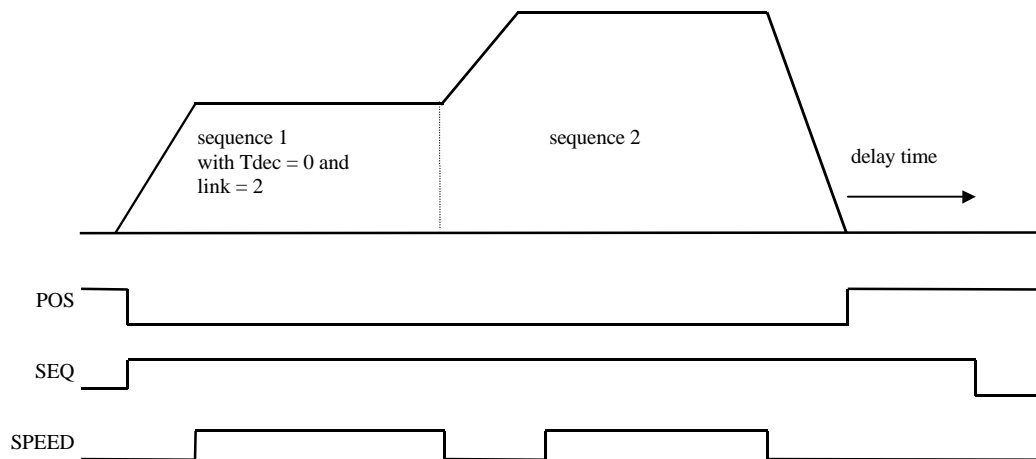
JOG+ Manual movement in positive direction.

JOG- Manual movement in negative direction.

IN1 to IN8 These inputs allow to define (binary code) the sequence that will be executed. They also allow to define a starting sequence condition.

5.2.0 Output logic description

- Amp OK** This signal indicates that the amplifier is ready (no error).
- Power OK** This signal indicates that the power supply is OK.
- BRAKE** This output controls the motor brake (if equipped).
- SEQ** This signal indicates that a sequence is presently executed.
- POS** This signal is activated when the motor reaches position, and remains enabled until the next motor movement. In case of a “forced” movement, this signal remains enabled.
- SPEED** This signal indicates that the speed is reached during a motor movement.
- OK** This signal indicates that the amplifier is ready for a movement (no error and amplifier enabled).



- OUT1 to OUT8** Programmable logic outputs. These outputs are only operating during a programmed sequence.

5.3.0 Axis Addressing

Each amplifier can have an address $\neq 0$. The amplifier has 4 micro-switches (SW1) allowing to define an address from 0 to 15 (see location of these switches in section 10.1.0 “Hardware adjustments”).

The addressing of an amplifier allows to communicate, from one single host, with several amplifiers via the serial link (RS-232 or RS-485).

5.4.0 Programmed speed reduction via analog input (option)

It is possible to get an optional analog input allowing to reduce the programmed speed. The motor speed is reduced with regard to the programmed speed, inversely proportionally to the analog input value. This speed reduction is applied to the programmed speed of all sequences as well as the manual speed.

6.0.0 COMMISSIONING

6.1.0 Checking the amplifier configuration

The **standard** amplifier configuration for MAVILOR motors with resolvers are the following:

- Personalization board PRES resolver: 4 x 12,7 K Ω 1 %.
- Adjustment of the current loops according to the table of chapter 8.1.0.
- Motor thermal switch PTC : jumper MN.
- Negative logic: jumpers E F G open.
- No auxiliary supply: jumper JK closed and jumper KL open.

See sections 10.1 to 10.4 for the amplifier adjustment to other motor or resolver types or to another logic control.

6.2.0 PC Software installation

The BD1M software is running under DOS operating system.

- Insert Disk in the appropriate drive (i.e. A drive)
- At the DOS prompt type **A: install**
- Choose the communication port (**COM1** or **COM2**) and start the installation by pressing [**INSTALL**].
- Connect the serial link RS232 between the PC and the amplifier.

6.3.0 Putting into operation

- Check the secondary voltage of the power transformer: Rated value 220 Vrms between phases, maximum value without load < 260 Vrms (including all variations, especially line fluctuations).
- Check the DC bus voltage on back of the rack: VDC \approx 310V, VDC max < 370 V, VDC min > 200 V.

- The braking resistor must remain cool (**CAUTION !** This resistor is under high voltage).

- Turn power off and wait until voltage drops below 10 V before plugging in the first amplifier.
- **ENABLE** and **RUN** inputs must be disabled.
- Plug in the amplifier and apply power.

1st CASE

Use without auxiliary power supply. When applying power, the green LED **ON** must light and the red **ERROR** LEDs must be off after the selftesting procedure of the amplifier.

2nd CASE

Use with auxiliary power supply (see section 10.4.2). When applying logic power, the **Undervolt** default may be displayed. Apply main power: the default is eliminated.

Caution note

In case of power shut down, **WAIT 5 SECONDS MINIMUM** before switching on the amplifier again.

WAIT 30 SECONDS after power down before handling the rack and/or the amplifiers (residual voltage)

6.3.0 Amplifier commissioning and adjustment

In the directory C:\BD1M, start the software by entering BD1M.

INFRANOR SMT-BD1/m PC-Software				
F1	F2 Parameters	F3 Single move	F4 Sequence setup	F5 Run sequence
F6	F7 Reset error	F8 Oscillo	F9 Misc.	F10 Exit
Sequence:		Inputs Outputs Controls		
REF (mm)	00095.000	START <input type="checkbox"/>	SEQ <input type="checkbox"/>	LOG- <input type="checkbox"/>
POS (mm)	00002.151	STOP <input type="checkbox"/>	POS <input type="checkbox"/>	FC+ <input type="checkbox"/>
SPEED (rpm)		WAIT <input type="checkbox"/>	SPEED <input type="checkbox"/>	FC- <input type="checkbox"/>
		TEACH <input type="checkbox"/>	OK <input type="checkbox"/>	RUN <input type="checkbox"/>
		JOG+ <input type="checkbox"/>		INDEX <input type="checkbox"/>
		JOG- <input type="checkbox"/>		ENABLE <input checked="" type="checkbox"/>
		IN1 <input type="checkbox"/>	OUT1 <input type="checkbox"/>	SERVO <input type="checkbox"/>
		IN2 <input type="checkbox"/>	OUT2 <input type="checkbox"/>	BRAKE <input checked="" type="checkbox"/>
		IN3 <input type="checkbox"/>	OUT3 <input type="checkbox"/>	
		IN4 <input type="checkbox"/>	OUT4 <input type="checkbox"/>	
		IN5 <input type="checkbox"/>	OUT5 <input type="checkbox"/>	
		IN6 <input type="checkbox"/>	OUT6 <input type="checkbox"/>	
		IN7 <input type="checkbox"/>	OUT7 <input type="checkbox"/>	
		IN8 <input type="checkbox"/>	OUT8 <input type="checkbox"/>	

The software screen is divided into 2 areas:

Menu area accessible by means of function keys (F1 to F10) on the PC keyboard,

Display area information regarding the axis (position, speed, logic inputs/output status).

The function keys **F1** to **F10** allow the access to various functions of the software. The menu tree structure is shown below:

F2: Parameters

F2: Motor

- F2: Motor list
- F3: Auto-phasing
- F4: Motor parameters
- F5: Phase lead calculation
- F6: Current limit
- F7: Speed limit

F3: Controller

- F2: Auto-tuning
- F3: Controller parameters
- F4: Stability gain

F4: Encoder output

F5: Input/Output configuration

F7: General parameters

F8: Manual move parameters

F9: Save parameters

F10: File

- F2: Load parameters
- F3: Save parameters
- F4: Save report
- F5: Print report

F3: Single move

F4: Sequence setup

F5: Down load

F2: Copy sequence

F3: Paste sequence

F7: Edit sequence

F8: Delete sequence

F9: Up load

F10: File

- *F2: Load*
- *F3: Save*
- *F4: Save report*
- *F5: Print report*

F5: Run sequence

F7: Reset error

F8: Oscillo

F9: Misc.

F10: Exit



Programming hints

The ESC key makes it possible to go up one level in the menu hierarchy.

Dialog window:

- Arrow keys allow to move between the various elements
- ENTER key allows to quit and confirm the modifications
- ESC key allows to quit without confirmation
- SPACE key allows to change a displayed selection on an element with multiple selection

6.4.0 Enabling

The amplifier can be enabled only when the **ENABLE** and **RUN** signals are activated.

ENABLE is a "hardware" signal that allows the amplifier inhibition in critical situations.

RUN is a "software" signal that allows the delay time control via the **BRAKE** output. During the Auto-phasing procedure, this signal must be inhibited and the **ENABLE** signal enabled.

If the motor brake is not used, the potential of the **RUN** signal should be set and the **ENABLE** signal should be used for the enabling/disabling (and not the contrary).

The brake control signal (**BRAKE**) is a low power signal that cannot directly control the motor brake. It must be connected to an external power relay for controlling the motor brake.

The brake control is enabled (contact open) or disabled (contact closed) according to the amplifier status (disabled or enabled).

6.5.0 Manual move

The manual move can be made as follows:

- **JOG+** and **JOG-** inputs: the motor moves at the programmed speed (see section 7.9.0 Manual move parameters)
- Serial link input: the BD1M software allows a single move by giving the home position (Menu **F3: Single move**).

7.0.0 PARAMETER SETTING

7.1.0 Current limitation

Menu **F2: Parameters** then **F2: Motor** then **F6: Current limit**

- Select the amplifier current limitation mode (**F6: Current limit**). When putting into operation, the **Fusing mode** is recommended.

In **Fusing mode**, the amplifier is disabled when the current limit threshold is reached (see section 10.3.3).

In **Limiting mode**, the current is only limited to the value defined by the parameter **Rated current** when the limit threshold is reached (see section 10.3.3).

- **Maximum current (%)** parameter defines the amplifier maximum current. It can vary between 20 % and 100 % of the amplifier current rating. This parameter is defined according to the amplifier and motor specifications (see section 2.1.0).
- **Rated current (%)** parameter defines the limit threshold of the amplifier RMS current (I^2t). It can vary between 20 % and 50 % of the amplifier current rating. This threshold is defined according to the amplifier and motor specifications (see section 2.1.0).

Caution note

Make sure the parameter values for **Maximum current** and **Rated current** are compatible with the motor **and** the amplifier

7.2.0 Speed limitation

Menu **F2: Parameters** then **F2: Motor** then **F7: Speed limit**.

- The parameter **Maximum speed** (rpm) defines the maximum motor speed. The speed range is between 100 and 10000 rpm with increment of 5 rpm.
- The function **Reverse movement** allows to reverse the motor rotation direction with regard to the sign of the position counter. The encoder position counting direction is not.

Caution note

Make sure that the parameter value **Maximum speed** is compatible with the motor and the application.

7.3.0 Motor parameters

Menu **F2: Parameters** then **F2: Motor** then **F2: Motor list**

- The menu **F2: Motors list** allows the selection of a motor in the motor list.

If the motor used is not in the motor list, please proceed as described below:

7.3.1 Amplifier adjustment to a new motor

Menu **F2: Parameters** then **F2: Motor** then **F3: Autophasing**

- Uncouple the motor from the mechanical load and check that the motor shaft has free rotation for one revolution that is not dangerous for the operator.
- Execute the **Autophasing** procedure (the **RUN** signal must be disabled and the **ENABLE** signal enabled) in order to get the parameters **Pole pairs**, **Motor phase** and **Resolver adjustment**. Note that during the auto-phasing procedure, the motor is automatically enabled and then disabled after the procedure.
- Calculate the parameter **Current phase lead**

Menu **F2: Parameters** then **F2: Motor** then **F5: phase lead calculation**

The effects of this parameter are useful for low inductance motors running at high speeds.

- The **Motor parameters** menu (F4) provides the calculated parameters by means of the auto-phasing procedure and the **Current phase lead calculation** parameter:
 - ◇ **Pole pairs** parameter defines the number of motor pole pairs.
 - ◇ **Phase order** parameter defines the order sequence of the motor phases.
 - ◇ **Resolver offset** parameter defines the mechanical shift between the motor reference and the resolver reference.
 - ◇ **Current phase lead** parameter defines the currents phase lead for the maximum motor speed. The phase lead is proportional to the motor speed and compensates the current loops phase shift in order to keep a maximum torque/current ratio in the motor.

7.4.0 Speed loop parameters (Autotuning)

Menu **F2: Parameters** then **F3: Controller** then **F2: Autotuning**

The auto-tuning procedure identifies the motor and load specifications and calculates the gain parameters of the regulator. During the execution of the procedure, the operator can select the regulator bandwidth (Low = 50Hz, Medium = 75 Hz and High = 100 HZ). These values correspond to the cut-off frequency for a 45° phase shift of the speed loop. Use the **Standard** filter.

- For executing the auto-tuning procedure when the motor is disabled, the **ENABLE** signal must be enabled and the **RUN** signal disabled.
- For executing the auto-tuning procedure when the motor is enabled (i.e. vertical load), both **ENABLE** and **RUN** signals must be enabled.

Caution note

Make sure that the motor shaft has free rotation for one revolution that is not dangerous for operator and machine before starting the auto-tuning procedure.

- After the auto-tuning procedure, check that the motor is correctly running in both directions **without current saturation**.

Programming hints

In case of loud noise in the motor at standstill or when running, check the rigidity of the mechanical transmission between motor and load (backlashes and elasticities in motor and couplings). If the problem remains, execute the autotuning function again with a lower bandwidth.

If the problem still remains, execute the auto-tuning function again by activating the **Antiresonance** filter.

- Adjust more accurately the loop response stability by adjusting the **Stability gain** (F4) if necessary.

7.4.1 Speed loop adjustment with a vertical load

In the case of an axis with an unbalanced load (constant torque due to a vertical load), proceed as follows:

- Select the current limitation mode **Limiting**.
- Initialize the regulator gains corresponding to the unloaded motor by executing the **Autotuning** procedure with the motor *uncoupled* from its mechanical load.
- Couple the motor to the load and select a *stable gain*.
- Move the shaft manually until a safe position is reached.

Caution note

Make sure that the motor shaft has free rotation for one revolution that is not dangerous for operator and machine before starting the auto-tuning procedure.

- Execute the **Autotuning** procedure with the motor at standstill. If the motor shaft is moving, the amplifier does not execute the procedure.

7.5.0 Encoder output parameters

Menu **F2: Parameters** then **F4: Encoder output**

The parameter **Encoder resolution** defines the equivalent encoder resolution on channels A and B of the encoder position output for one motor shaft revolution. Binary and decimal values are both accepted. The maximum encoder resolution is limited by the motor rotation speed as shown in the table below:

Max. possible speed (rpm)	900	3600	14 000
Max. encoder resolution	8192	4096	1024

- **Number of zero pulse** parameter defines the number of zero pulses on channel Z for one revolution of the motor shaft. The adjustment range is between 1 and 16.
- **Zero pulse origin shift** parameter defines the shift between the first zero pulse on channel Z and the resolver marker pulse. The adjustment range is between 0 and 32768 points. 32768 points correspond to one revolution of the motor shaft.
- **Zero pulse width** parameter defines the width (as a resolution) of the zero pulses on channel Z. The adjustment range is between 8 and 32768 pulses. 32768 corresponds to one revolution of the motor shaft. The **ENABLE** signal must be disabled before validating these parameters by **[OK]**. The amplifier will then execute the programming of the encoder output (about 5 s).

7.6.0 Inputs - outputs configuration

Menu **F2: Parameters** then **F5: Input/Output configuration**.

- **Inputs polarity** defines the polarity of the optocoupled inputs START, STOP, WAIT, TEACH, JOG+, JOG-, IN1 to IN8: an input signal that is not checked off with an [X] corresponds to positive logic (active with 24V input)
- **Sequence control**: The inputs IN1 to IN7 can be used for selecting sequences (checked off with an [X]). There are a maximum of 128 sequences that can be selected with the inputs IN1 to IN7 (in binary code).
- **Output polarity**: defines the polarity of the optocoupled outputs SEQ, POS, SPEED, OK, OUT1 to OUT8: a signal that is not checked off with an [X], corresponds to the open collector output transistor.
- **Output pulse**: the outputs OUT1 to OUT8 can be defined as pulse outputs (checked off with an [X]). The duration is defined by the parameter **output pulse duration** (1 to 16000 ms).

7.7.0 Scaling parameters

Menu **F2: Parameters** then **F6: Scale parameters**.

This menu defines the following parameters:

- **Position resolution**: defines the position resolution for one motor revolution according to the desired number of decimals and the desired unit. The value range is between 16 and 65536 per revolution.
- **Decimal**: number of decimals.
- **Unit**: defines the unit used.

Programming hints

Example: For a resolution of 4 mm/motor rev., where the number of decimals = 3:

Resolution = 4000

Decimal = 3

Unit = mm

7.8.0 General parameters

Menu **F2: Parameters** then **F7: General parameters**.

This menu allows to define the following parameters:

- **Following error threshold**: defines the triggering threshold of the following error.
- **Speed profile**: Trapezoidal or S-curve.
- **Brake ON delay**: defines the time between brake enabling and motor disabling:
 - ◇ brake ON (contact open)
 - ◇ delay time,
 - ◇ amplifier disabled.

- **Brake OFF delay:** defines the time between brake enabling and disabling:
 - ◊ amplifier enabling
 - ◊ delay time
 - ◊ brake OFF (contact closed)
- **CLR input enable:** when activated (checked off with an [X]), allows to use the **INDEX** input for re-initializing the position counter. As this signal toggles from one state to another, the value defined by the parameter below will be loaded in the position counter.
- **Clear position value:** defines the value to be entered in the position counter when the **CLR** function is used.
- **Reset counter:** this function allows to reset the position counter when it reaches a pre-defined value. If the value is set at 0, this function is not activated.
- **Forward:** If this parameter is activated (checked off with an [X]), the motor turns in positive direction for an absolute displacement that is lower than the value of the **Reset counter** parameter.
If this parameter is not activated (not checked off), the motor follows the shortest way for an absolute displacement that is lower than the value of the **Reset counter** parameter.
- **Analog input limitation:** this function allows to use an external analog input (speed reduction). This is only possible when the option **analog input** is available.

The positioning speed is then limited with regard to the programmed speed value in an inversely proportional way to the analog input value. This speed reduction is applied to the programmed speed of all sequences as well as to the manual displacement speeds.

Programming hints

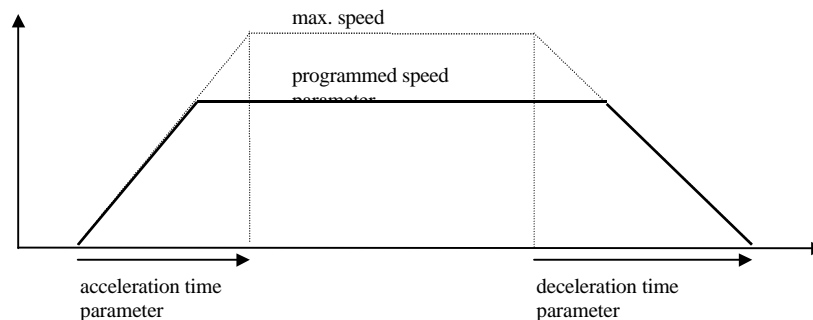
- When the analog input is 0V, the motor runs at the programmed speed. A 5V input controls the motor at half of the programmed speed.
- A 15V output signal is available on the X4 connector and allows to use a "speed reduction" potentiometer.

7.9.0 Manual move parameters

Menu **F2: Parameters** then **F9: Move parameters**

This menu defines the parameters **movement speed**, **acceleration time** and **deceleration time** during a movement via **JOG+**, **JOG-** or via the serial link (function **F3 Single move** in the main menu).

- **Acceleration time** and **deceleration time** parameters define the time with regard to the maximum speed (defined by the parameter "Speed limitation"). When the programmed speed is lower than the maximum speed, the acceleration and deceleration times are proportionally smaller:



7.10.0 Saving parameters

Menu **F2: Parameters** then **F9: Save parameters**

When all adjustments are made, the parameters must be saved in the amplifier non volatile memory. This is done by executing the menu **Save parameters** with the ENABLE signal disabled.

7.11.0 Files parameters

Menu **F10: File**

This menu allows the access to the following functions:

- Parameters saving on disk (F3: Save parameters).
- Loading of the saved parameters on disk (F2: Load parameters).
- Parameters saving as a text file (F4: Save report).
- Parameters printing (F5: Print report).

8.0.0 PROGRAMMING

8.1.0 General description

Sequences programming are accessible via the menu **F4: sequence setup**.

INFRANOR SMT-BD1/m PC-Software												
F1			F2 Load sequences			F3 Save sequences			F4 Save report		F5 Print report	
F6			F7			F8			F9		F10	
Seq	Move	Pos	Speed	Tacc	Tdec	Delay	Output	Output	Next	Count	Loop	
		mm	rpm	ms	ms	ms	87654321	trig.				
0	Abs.	0.000	500	800	800	1000	.....001	End	1			
1	Abs.	1.000	500	800	800	1000	.....010	End	2	4	0	
2	Abs.	2.000	500	800	800	1000	.....100	End				
3	Home	0.000	500	800	800	10	T.....	+YNY				
4												
5												
6												
7												
8												
9												
10	Rel.	0.000	1000	500	500	500	1.....	Begin	11			
11	Rel.	0.000	1000	500	500	500	.1.....	Begin	12			
12	Rel.	0.000	1000	500	500	500	..1.....	Begin	13			
13	Rel.	0.000	1000	500	500	500	...1....	Begin	14			
14	Rel.	0.000	1000	500	500	500	....1...	Begin	15			

F2: Copy sequence: Copy the highlighted sequence.

F3: Paste sequence: Paste the copied sequence.

F5: Download: Transfer the program (128 sequences) from the amplifier to the PC. The amplifier must be disabled during the transfer.

F7: Edit sequence: Edits the highlighted sequence.

F8: Delete sequence: Deletes the highlighted sequence.

F9: Upload: Transfer the program (128 sequences) from the PC to the amplifier. The amplifier must be disabled during the transfer.

F10: File: Allows the access to the following functions:

- Program saving (sequences list) on a disk (F3: Save sequences).
- Loading a program saved on the disk (F2: Load sequences).
- Sequence list saving as a text file (F4: Save report).
- Sequences list printing (F5: Print report).

Programming hints

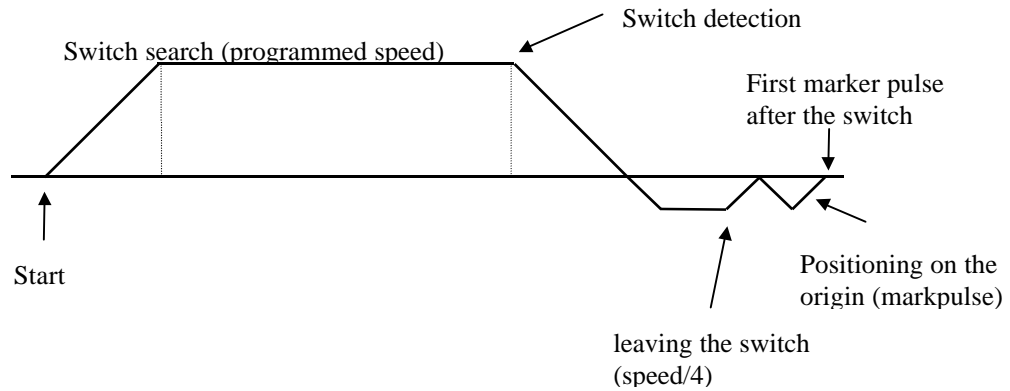
When the "Resolution" parameter is modified, all position values in the sequences are also modified. When the parameter "Max. motor speed" is modified, all speed parameters in the sequences are also modified. Consequently, when a sequence file is sent to the SMT-BD1/m amplifier, it must be programmed before with the correct parameters "Position resolution" and "Max. motor speed".

8.2.0 Editing a sequence

Sequence parameters:

Move Defines the movement type.
ABS: positioning in absolute dimension.
REL: positioning in relative dimension.
HOME: research procedure of the axis origin.

Procedure diagram of the **HOME** origin search:



Pos Distance to be reached, absolute or relative according to the above parameter. If **Move** is the origin search procedure, **Pos** is the value to be loaded into the position counter for the detected position.

Speed Defines the motor speed in rpm.

Tacc Defines the acceleration time in ms.

Tdec Defines the deceleration time in ms. This parameter can be = 0 when chaining is made without stopping the motor. See also section 7.9.0 "Manual move parameters."

Delay / TimeOut Defines, in ms, the time delay at the end of the positioning.
 If the movement is the origin search procedure, this parameter defines, (in seconds) the "time out" after which the amplifier displays an error (if it does not find the index position. If this value is set at 0, the "time out" error is not activated.

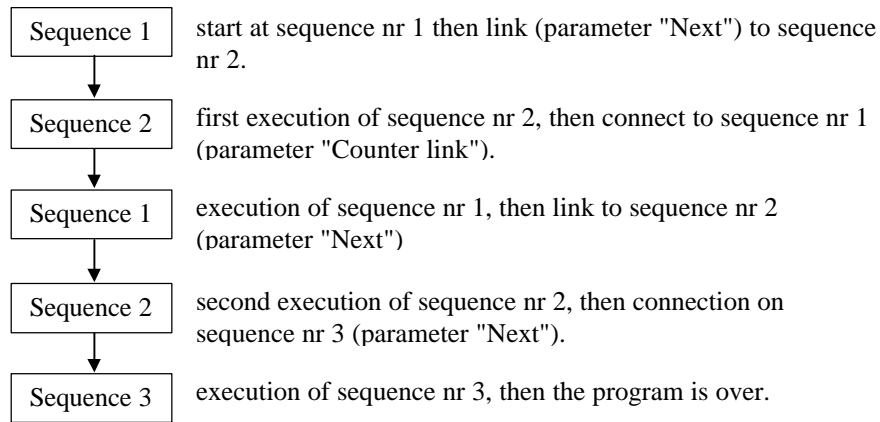
Next Defines the sequence to be executed after the current one.

Counter Defines how many times the sequence must be executed. This counter will be decremented at each executed sequence.

Counter link Defines the sequence number to be executed when the **Counter** parameter is greater than 0

Programming hints

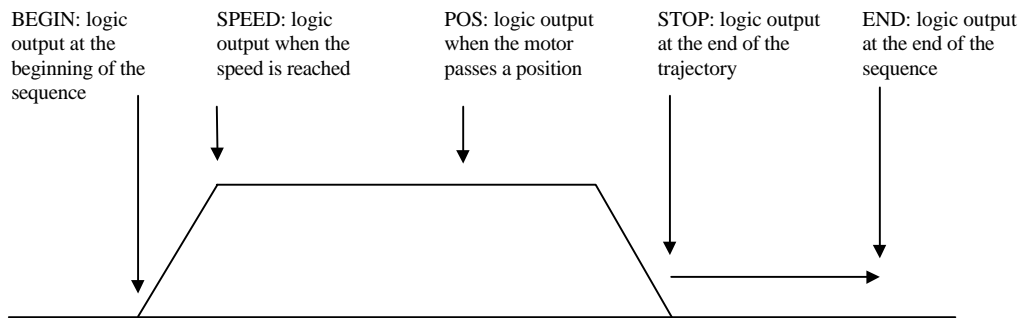
Example:	SEQ 1: Next = 2	Counter = ---	Counter link = ---
	SEQ 2: Next = 3	Counter = 2	Counter link = 1
	SEQ 3: Next = ---	Counter = ---	Counter link = ---



Output Defines the statement of the 8 outputs:

- do not change the output state
- 1** set the output at 1
- 0** set the output at 0
- T** toggle the output

Output trigger Defines the triggering moment of the outputs according to one of the five solutions below:

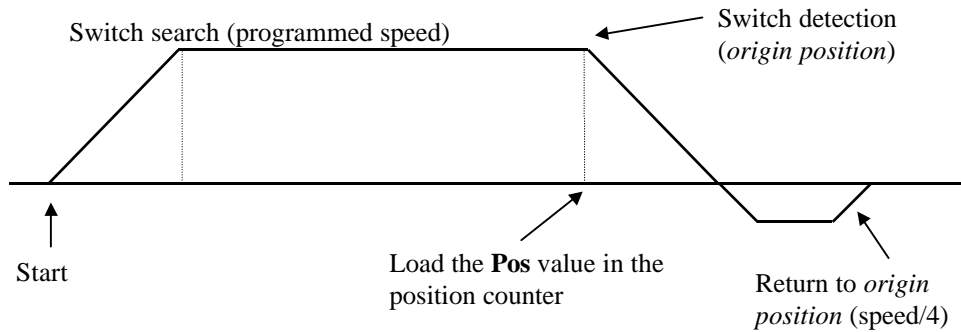



The outputs can also be preset as pulse outputs (cannot be modified by means of a program) with a preset duration. This type of output only concerns the outputs set at 1 or "toggle" (see section 7.6.0 "Inputs - outputs configuration").

Home control Define the **HOME** origin search, the parameters are:

- Dir** Search direction, "+" for the positive direction and "-" for the negative direction.
- Switch** Origin search with switch detection.
- Zero** Origin search with marker pulse direction.
- Origin** In the case of a switch, this parameter allows coming back to the origin position (reverse motion), otherwise, the motor will be stopped after the deceleration.
- Reset** Load the **Pos** value in the position counter at the origin position.

Procedure diagram with switch search:




 **Programming hints**

If **Switch** = Y and **Zero** = Y or **Origin** = Y, the speed reversal is commanded by the switch detection.


Output pos. Defines the position where the output must be triggered if it has been programmed (see above).

Start condition The inputs that are not defined as sequences selection inputs can be programmed in order to define a sequence starting condition.

 **Programming hints**

Example: As the inputs 1 to 5 are sequences selection inputs, the inputs 6 and 8 can be used for starting condition.
"Start conditions: 0 . 1"
 Inputs 1 to 5 and 7 are not concerned by the starting condition
 With these conditions, this sequence can only be executed if input 6 is set at 1 and input 8 at 0.

A conditional sequence connection can be programmed via the inputs by combining the **start condition** for the inputs with the **counter link** parameter. The **counter** parameter must be empty. The sequence will be executed if the **start condition** inputs are ready. Otherwise, it will not be executed and the program directly switches on to the sequence indicated by the **counter link** parameter.

 **Programming hints**

Example: Sequence 1: Next = 2
 Counter =
 Counter link = 4
 Start condition = 1..... (IN8 input)

When executing this sequence:
 If IN8 input = 1, sequence 1 will be executed, the program switches on to sequence 2.
 If IN8 input = 0, sequence 1 will not be executed, the program directly switches on to sequence 4.
 If, the parameter **counter link** is left empty, the program waits until the **start condition** inputs are ready for executing the next sequence

8.3.0 Program execution

The execution of a sequence can be made:

- START input logic: this input triggers the execution of the sequence defined by the inputs IN1 to IN7 (in natural binary code),
- Serial link input: The BD1M software allows the execution of any sequence with:

menu **F5: Run sequence**

Then, enter the number of the sequence to be executed.



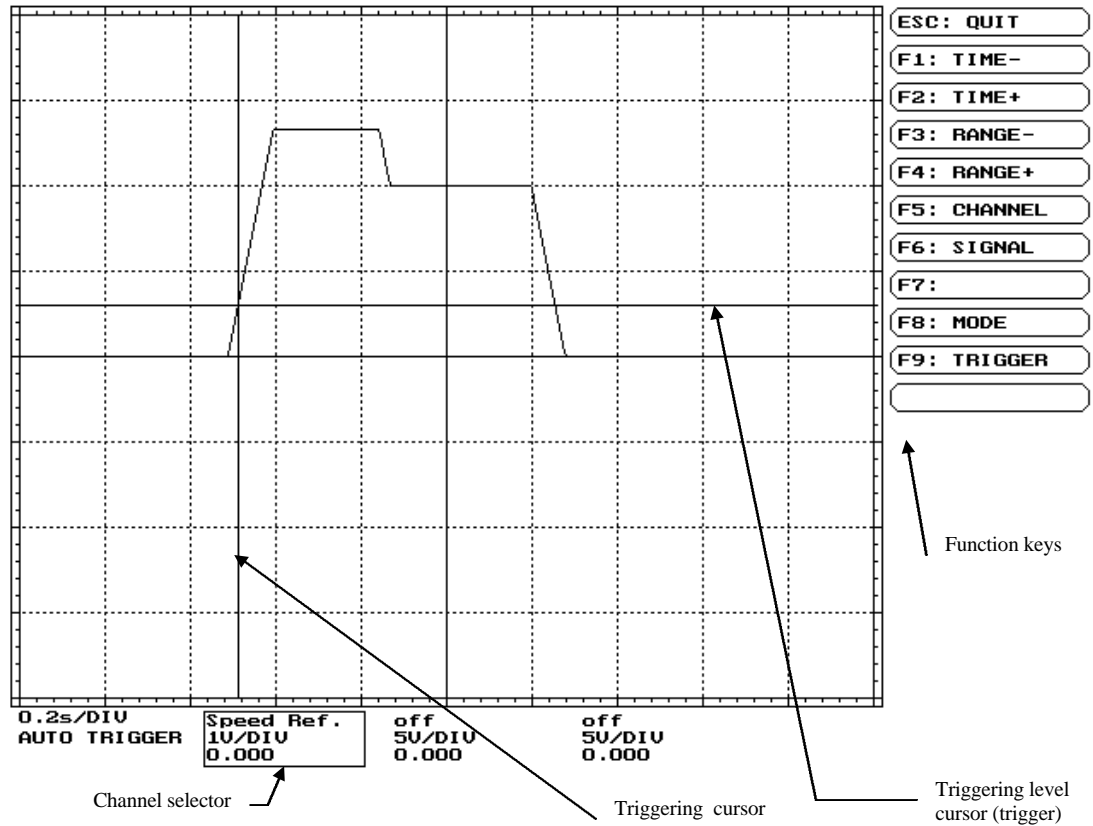
Programming hints

A sequence execution requires the enabling of the **OK** signal.

8.4.0 Oscilloscope functions

Menu F8: Oscillo

This menu allows the access to the Oscilloscope screen:



F1 and F2 Change the time base.

F3 and F4 Change the amplitude of the channel indicated by the “channel selector”.

F5 Set the “channel selector” on channels 1, 2 or 3.

F6 Allocate a signal (Imon, Iref, Speed ref, Speed mon...) to the channel indicated by the “channel selector”

F8 Change the operation mode:

- Continuous
- By one single triggering
- By continuous triggering

F9 RUN or STOP the oscilloscope trace

Offset Keys **page up** and **page down** allow to introduce an offset, on the screen, to the signal selected by the selector.

File In **Auto trigger** or **Single trigger** mode only

alt + F2 Loading previously saved oscilloscope file.

alt + F3 Saving the oscilloscope curves in a file.

 **Caution note**

The saved files can be read by BPCW 2.6 (The opposite is not possible)

Zoom The curves in **Auto trigger** or **Single trigger** mode can be zoomed with the keys **ctrl + page up** and **ctrl + page down**.

The keys **ctrl +** and **ctrl +** allow to move the zoomed curves.

9.0.0 FAULT FINDING

9.1.0 System default

If the red **SYS** led is lit, the logic board is defective.

- Check that the EPROM firmware memory is correctly plugged into the amplifier.
- Check that the EPROM version is x.x8 or higher
- Check for the possible presence of any conducting dust that may result in short-circuits on the logic board.

9.2.0 Stored defaults

In order to simplify diagnostic and maintenance, the defaults are displayed and processed with the priority described below. For safety reasons, the power must be turned off to reset some defaults that require the handling of the amplifier. In this case, the reset is automatic when power is turned on again. If power is not turned off, do not forget to make a RESET immediately after the fault reset (pin 13 of X4).

9.2.1 “Busy” default

- If the **BUSY** default is continuously displayed after applying power to the amplifier, the selftesting procedure has failed and the board is not ready for operation.
- If the **BUSY** default is continuously displayed after execution of the **AUTOPHASING** function, the procedure has failed because of an external cause or the calculated parameters are wrong. Check that the ENABLE input is open. Then check that the motor is uncoupled and the shaft movement is free during the procedure.
- If the **BUSY** default is continuously displayed after execution of the **AUTOTUNING** function, the procedure has failed because of an external cause or the calculated parameters are wrong. Check that the ENABLE input is open. Then check that the motor is uncoupled and the shaft movement is free during the procedure.
- This fault may also occur during a HOME origin search procedure where the “delay/time out” is too short.

9.2.2 “NovRAM” Default

- Check the presence of the NovRAM and check its correct orientation.
- If the default remains, the NovRAM is not correctly initialized (checksum) or is not compatible with the amplifier software.
- To cancel this fault:
 - due to the parameters; program the amplifier parameter setting and save the parameters again,
 - due to the sequences; send the sequences again in the amplifier.
- This fault may occur when enabling the motor during a parameter saving or during a transfer between PC and amplifier.

It is important, when handling the memory, to avoid any physical contact with the circuit pins or to avoid any short-circuit between the pins.

9.2.3 Motor overtemperature

If the default appears when starting the amplifier:

- Check the configuration of the MN and OP jumpers with regard to the motor type.
- Check the connection between the thermal switch and the amplifier on the front panel X1 connector or the X6 connector on the back of the rack.

If the default appears during the operation:

- Check the motor temperature and look for the reason of this overheating (mechanical shaft overload, duty cycle too high, ...)

9.2.4 Undervoltage default

If the default appears when starting the amplifier: Check that the power supply is on.

9.2.5 “0C Amplifier” default

Check that the correct fan is installed with regard to the rated current required (see chapter 2.1.0).

9.2.6 “Power stage” default

If the default appears when starting the amplifier:

- Check the DC bus voltage and the terminal voltage of the power transformer secondary (DC bus < 370VDC and V secondary < 260VAC).

If the default appears during operation:

- Check the braking system during the deceleration phases,
- Check the sizing of the braking resistor with regard to the deceleration phases.
- Check that the duty cycle corresponds to the current table (see chapter 2.1.0).
- Check for short-circuit in the motor wiring and at the motor terminals.

9.2.7 “Resolver” default

- Check the resolver connection on the amplifier connector X1.
- Check the presence of the P-RES components.
- Check that the resolver type is correct with regard to the P-RES components;
- Check the connections between the resolver and the amplifier.

9.2.8 **“R.D.C” default**

If the default appears when starting the amplifier:

- Check that the values of the P-RES components and the resolver transformation ratio are correct.

If the default appears during operation:

- Check that the motor speed does not exceed the speed limits defined below:
 - If **Max. speed** < 900 rpm, then the speed is limited to 900 rpm.
 - If 900 rpm < **Max. speed** < 3600 rpm, then the speed is limited to 3600 rpm.
 - If 3600 rpm < **Max. speed** < 14000 rpm, then the speed is limited to 14000 rpm.

9.2.9 **“I²t” default**

- Check the continuous current value required with regard to the table of currents authorized in pulse mode cycle (see chapter 2.1.0).
- Check the continuous current of the amplifier defined in the **Rated current** parameter with regard of the current required for the operation cycle.

9.3.0 **Operating problems**

9.3.1 **No motor movement**

- Check that the power supply is on.
- Check the amplifier fuses (F1 and F2) and the motor connection.
- Check the logic wiring of the signals FC+, FC-, RUN and ENABLE (see section 10.4.1).
- Check that the amplifier is enabled.

9.3.2 **Motor movement, but no torque**

- Check that the **Maximum current** and **Rated current** parameters have no zero value.

9.3.3 **Shaft locked, erratic oscillations or rotation at maximum speed**

- Check that the proper motor is chosen in the **MOTOR LIST** module.
- Check the resolver wiring on the X1 connector and the mechanical mounting of the resolver on the motor.
- Check the value of the **MOTOR PARAMETERS** (number of pair pole, resolver adjustement, motor phase, etc.).

9.3.4 **Erratic motor rotation with zero torque positions**

- Check the connection of the three phase cables between motor and amplifier.

9.3.5 Loud crackling noise in motor at standstill

- Check that the motor-amplifier-controller ground connections correspond to the recommendations of chapter 4.0.0.

9.3.6 Loud noise in the motor at standstill and when running

- Check the rigidity of the mechanical coupling between motor and load (backlash and elasticity in the gearbox and coupling).
- Execute the **AUTOTUNING** command again by choosing a lower band width (Medium or Low).

9.3.7 Loss of serial port communication during operation

- Check that serial port cable is properly connected to the amplifier and the PC (see section 3.6.0 and 4.1.2)
- Verify that the serial port on the PC side is operational.
- Some custom VGA video drivers are incompatible with the serial port interrupt and it may be necessary to use a standard Windows video driver such as: **VGA (Version 3.0)** located in the *Windows Setup* menu.

9.4.0 Service and maintenance

When exchanging an amplifier on a machine, proceed as follows:

- Check that the new amplifier has the **same hardware** configuration as the old amplifier,
- Plug in the parameter EEPROM (or a copy of it) of the old amplifier onto the new one,

The new amplifier is then configured like the old one.

10.0.0 APPENDIX

10.1.0 Handheld terminal operation

10.1.1 Terminal configuration

- A display with 4 lines of 20 characters each:
- A keyboard with:
0...9 keys,
ENTER key,
arrow keys.
- A serial link RS232:
19200 baud, 8 bits, 1 stop bit, no parity.
Protocol VT-100.

10.1.2 Positioner configuration

- SMT-BD1/m with software **version 5.98** or higher.
- Switch SW2.4 = OFF. PC mode: this mode is used to communicate with the PC software **BD1m**.
- Switch SW2.4 = ON. Terminal mode to communicate with a VT-100 terminal.

The switch SW2 is next to the X4 connector.



Programming hints

It is possible to switch between these modes by means of the **Offset** push button on the front panel.

10.2.0 Operation

10.2.1 Main menu

1 Display position
2 Modify sequence
3 Run sequence
4 Move_

- 1** *Display the motor position* : can move the motor (Jog+ or Jog-) by means of the arrow keys.
- 2** *Modify a defined sequence*:
modification of the position of a defined sequence: enter the sequence number and its new programmed position.
modification of the speed of a defined sequence: enter the sequence number and its new programmed speed.
- 3** *Run a sequence*: enter the sequence number to execute.
- 4** *Move to a position*: enter the position to move to.

10.2.2 Display position

```
SMT-BD1/m  
103.000 mm
```

The arrow keys allow to move the motor (jog + or jog -), when the ENABLE and RUN signals are active.

The **Enter** key allows to go back to the main menu.

While in this screen, the motor can be stop (if running) by pressing the key **0**

```
STOP?_
```

The key **Enter** must pressed to confirm motor stop or any other key to abort.

10.2.3 Modification of a sequence

This menu gives the operator the possibility to modify position or speed of a defined sequence.

```
MODIFY SEQUENCE  
1 Position  
2 Speed_
```

The operator enters first the sequence number (this sequence must exist):

```
MODIFY POS  
Sequence:_  
Pos:  
Pos:
```

The old position will be displayed, and the operator can then enter a new position, or cancel by pressing only the ENTER key.

```
MODIFY POS  
Sequence:1  
Pos:45.000  
Pos:_
```

The operator can modify the same way the speed of a defined sequence:

```
MODIFY SPEED
Sequence:1
Speed:1000
Speed:__
```

10.2.4 Execute a sequence

When: The positioner is not executing any sequence,
Signals **ENABLE** and **RUN** are active,

A sequence number can be entered to be executed:

```
RUN SEQUENCE
Sequence:__
```

10.2.5 Movement

When: The positioner is not executing any sequence,
Signals **ENABLE** and **RUN** are active,

A position can be entered to move to:

```
MOVEMENT
Pos:__
```

10.3.0 Instructions list

10.3.1 Overview

The specifications of the SMT-BD1/m amplifier serial link are:
8 data bits, 1 stop bit, no parity and 19200 baud.

The parameters can be sent to the amplifier by an ASCII terminal using the instructions list given in this manual. Each instruction is coded as 2 ASCII characters with or without parameter.

Each instruction, which can be followed by one or two parameters sent to the amplifier, must end with a **carriage return** character (ASCII code 13). The parameters must be separated by a comma “,”(ASCII code 44).

All these characters, except for the **carriage return**, will be sent back by the amplifier (echo).

The amplifier answer starts with a the character “:” (ASCII code 58) possibly followed by a value. The amplifier will then send a **carriage return**, a **line feed** (ASCII code 10) and “>” (ASCII code 62).

These instructions allow to modify or to read the value of a variable. If there is a parameter, the variable corresponding to the instruction will take this value. Otherwise, the amplifier will send back the actual variable value.

Programming hints

- If the amplifier does not know the instruction, it will send back "?" instead of ":".
- Some instructions are only valid when the amplifier is disabled.
- If the entered parameter is out of the appropriate variable range or if the restrictive condition (amplifier disabled) is not answered, the parameter will not be taken into account (the amplifier will keep the former variable value).

The amplifier normally works in hexadecimal. The switch SW2.1 (the switch SW2 is near the X4 connector) allows to switch to decimal mode at power up.

SW2.1 = OFF hexadecimal mode,

SW2.1 = ON decimal mode.

- The **BD1m** software always changes the amplifier in hexadecimal mode independently of the status of SW2.1. It is necessary to exit **BD1m** to set the amplifier in default mode (hexadecimal or decimal mode).

Communication examples:

The user sends the **NP** instruction (number of motor pole pairs):

NP4

and a **carriage return** character for ending the instruction.

The amplifier will answer with:

NP4:

>

NP4 is the echo of the characters sent. ":" indicates that the instruction has been decoded. The value **4** is stored in the variable corresponding to the number of motor pole pairs. After the **character carriage return**, the amplifier will also send the ">" character in order to indicate that it is ready for a new instruction.

If the user sends the instruction:

NP

The amplifier will answer with:

NP:4

>

As there is no parameter in the instruction, the amplifier sends back the actual number of pole pairs.

10.3.2 Instructions list

All instructions described below are specific of the SMTBD1/m positioner. Other standard instructions are described in the standard instructions list manual of the SMTBD1 standard drive.

Modify position of a sequence

Instruction	UP
Parameters	1st parameter: sequence number. 2nd parameter: position value. If there is no 2nd parameter, the amplifier will return the actual position value of the sequence (1st parameter).
Conditions	This instruction can be sent only if there is no sequence executed. The sequence must exist.
Unit	The unit of the position value is defined by "position resolution" and "decimal number" defined in BD1m software. The value must be sent without the decimal point. Example: position resolution: 5000 decimal number: 3 unit: mm If the user wants to set a value 100 mm to sequence 3, the instruction will be: UP3,100000 (in decimal mode)

Modify speed of a sequence

Instruction	US
Parameters	1st parameter: sequence number. 2nd parameter: speed. If there is no 2nd parameter, the amplifier will return the actual speed of the sequence (1st parameter).
Conditions	This instruction can be sent only if no sequence is executed. The sequence must exist. The minimum speed is 20 rpm.
Unit	rpm.

Modify acceleration of a sequence

Instruction	UA
Parameters	1st parameter: sequence number. 2nd parameter: acceleration time. If there is no 2nd parameter, the amplifier will return the actual acceleration time of the sequence (1st parameter).
Conditions	This instruction can be sent only if no sequence is executed. The sequence must exist.
Unit	second.
Range	16 s - 16000 s.
Remark	See SMT-BD1/m manual for the "acceleration time" signification.

Modify deceleration of a sequence

Instruction	UD
Parameters	1st parameter: sequence number. 2nd parameter: acceleration time. If there is no 2nd parameter, the amplifier will return the actual deceleration time of the sequence (1st parameter).
Conditions	This instruction can be sent only if no sequence is executed. The sequence must exist.
Unit	second.
Range	16 s - 16000 s.
Remark	See SMT-BD1/m manual for the "deceleration time" signification.

Execution of a sequence

Instruction	GO
Parameters	1st parameter: sequence number.
Conditions	This instruction can be sent only if no sequence is executed. "Enable" and "Run" signals are activated. "Wait" and "Stop" inputs are not activated. The sequence must exist.
Remark	This instruction executes a sequence (with parameter as sequence number) regardless of the logic inputs status.

Position feedback

Instruction	PF
Parameters	none.
Conditions	Read only.
Remark	This instruction reads the position of the motor.
Unit	see <i>modify position of a sequence</i> .

Inputs/Outputs status

Instruction	IO
Parameters	no.
Conditions	Read only.
Remarks	This instruction reads the logic inputs and outputs status.

<u>bit</u>	<u>meaning</u>
0	START
1	STOP
2	WAIT
3	TEACH
4	JOG+
5	JOG-
8	SEQ
9	POS
10	SPEED
11	OK
16	IN1
17	IN2
18	IN3
19	IN4
20	IN5
21	IN6
22	IN7
23	IN8
24	OUT1
25	OUT2
26	OUT3
27	OUT4
28	OUT5
29	OUT6
30	OUT7
31	OUT8

- Bit SEQ indicates that the positioner is running a sequence.
- A sequence can be executed when bit OK is set and bit STOP is reset, and also if the security of the first sequence is disabled.

Absolute move

Instruction MP
Parameters absolute position.
Conditions "Enable" and "Run" signals are activated.
Remark
Unit *see modify position of a sequence.*

Speed (absolute movement)

Instruction DS
defines the speed for absolute movement (MP).
Parameters speed
Conditions
Remark This parameter is saved in the positioner memory.
Unit rpm.

Acceleration (absolute movement)

Instruction DA
defines the acceleration for absolute movement (MP).
Parameters acceleration time.
Conditions
Remark See SMT-BD1/m manual for the "acceleration time" signification.
This parameter is saved in the positioner memory.
Unit ms.

Deceleration (absolute movement)

Instruction DD
defines the deceleration for absolute movement (MP).
Parameters deceleration time.
Conditions
Remark See SMT-BD1/m manual for "deceleration time" signification.
This parameter is saved in the positioner memory.
Unit ms.

Stop

Instruction SOFF
Parameters
Conditions
Remark Stops all movements except for jog.
Unit

10.4.0 Hardware adjustments

All hardware adjustments of the **SMT- BD1** amplifier module are located on the hardware location diagram (see next page).

For the BL and MA MAVILOR motor series, the current loop adjustments are made by means of jumpers B1, B2, B3 or by the Personalization boards PC1, PC2, PC3, PC4 according to the table below:

AMPLIFIER MOTOR	8 A	12 A	17 A	30 A	45 A	60 A	70 A	100A	Thermal sensor
MA 3	B1								NTC
MA 6	B1	B1							PTC
MA 10	B2	B1	B1	B1					PTC
MA 20	B2	B1	B1	B1	B1	B1			PTC
MA 30			B2	B2	B2	B1	PC1		PTC
MA 45				B2	B2	B1	PC2	PC1	PTC
MA 55					B2	B2	PC4	PC3	PTC
BL 71	B2	B1							NTC
BL 72	B2	B1	B1						NTC
BL 73	B2	B2	B1						NTC
BL 74	B2	B2	B1						NTC
BL 111	B1	B1							PTC
BL 112	B2	B2	B1	B2					PTC
BL 113	B3	B3	B2	B2	B2				PTC
BL 114			B3	B3	B2	B2			PTC
BL 115			B3	B3	B2	B2	PC4		PTC
BL 141			B2	B2	B2	B1	PC2		PTC
BL 142			B3	B3	B2	B2	PC3		PTC
BL 143			B3	B2	B2	B1	PC2	PC1	PTC
BL 144			B2	B2	B2	B1	PC1	PC1	PTC

PC1: RA = 270 k Ω CA = 470 pF C14 = 82 pF

PC2: RA = 220 k Ω CA = 560 pF C14 = 100 pF

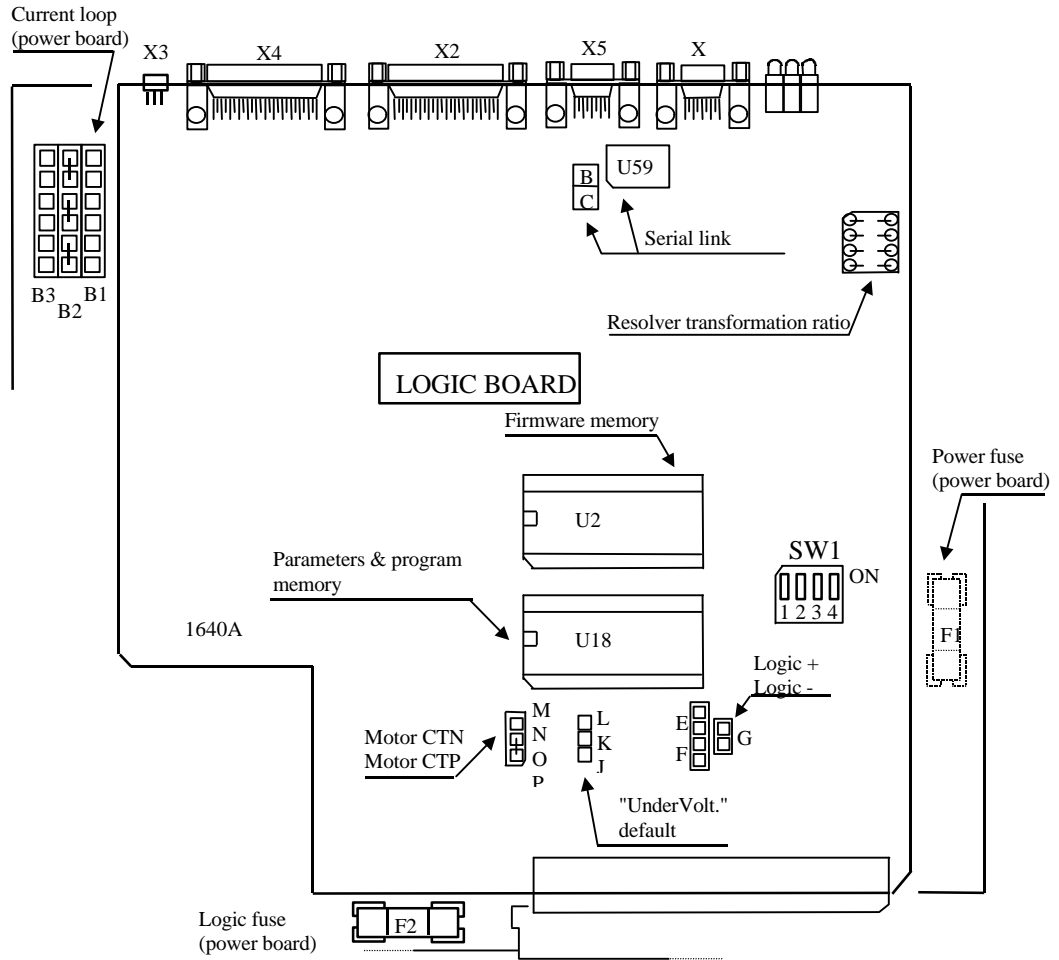
PC3: RA = 160 k Ω CA = 680 pF C14 = 150 pF

PC4: RA = 120 k Ω CA = 820 pF C14 = 150 pF

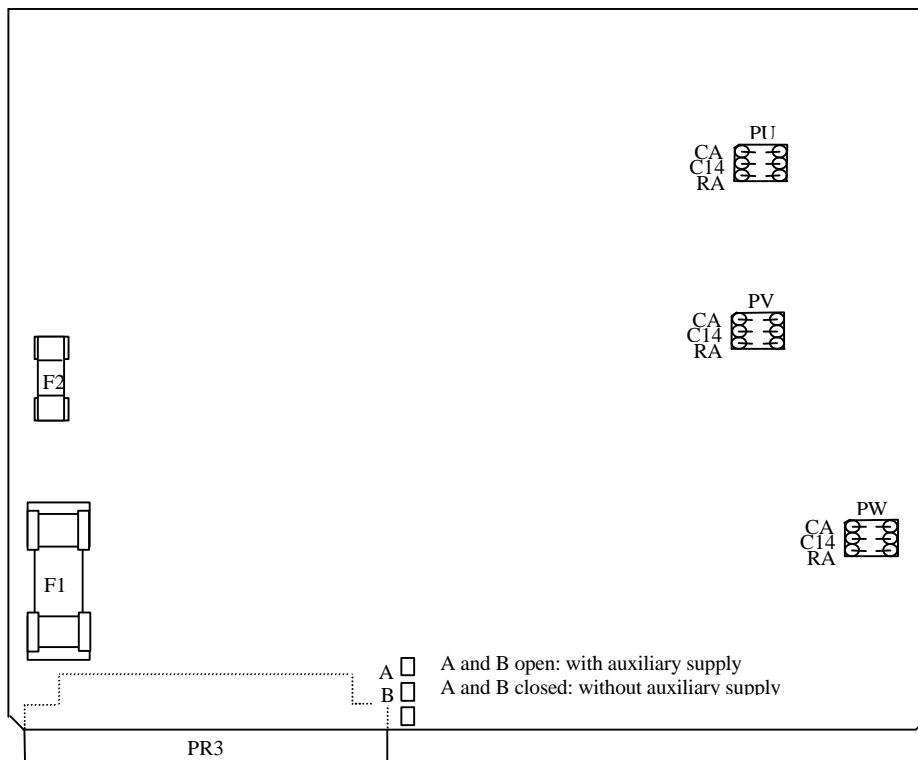
The standard serial link is the RS-232 link, with jumper B closed. Optionally, the amplifier can be delivered with a RS-485 serial link, with jumper C closed.

The Firmware memory of the standard amplifier version is **X.X8**

For amplifiers 4A to 60A:



For amplifiers 70A to 100A:



10.5.0 Resolver connections

INFRANOR		MOOG	MAVILOR MA / BL	MAVILOR BLS 05/07	BALDOR BSM	GETTY	ID 206
SMTB X1	CABLE						
4 (+sin)	yellow	C	A	2	D	N	B
8 (-sin)	blue	D	B	1	N	P	A
3 (+cos)	black	B	D	4	M	C	D
7 (-cos)	red	A	C	3	E	D	C
5 (+ref)	red/white	E	E	5	G	A	F
9 (-ref)	yellow/white	F	F	6	F	B	E
Shield	Shield	-	G	9	L	R	-

Caution: For cable recommendations, refer to section 4.2.2.

For use of resolvers with transformation ratios different than 0,5, the Cos and Sin signal amplitude must be adjusted by means of the "P RES" components according to the table below:

TRANSFORMATION RATIO	P RES			
	0.3	0.45	0.5	1
A - B - C - D 1 %	21 K	14.3 K	12.7 K	6.34 K

It may be necessary, for some resolvers, to adjust the phase shift between the Cos and Sin reference signals, by means of a specific capacitor. This adjustment is factory set by INFRANOR.

10.6.0 Motor connections

INFRANOR		MOOG 303	MOOG 304- 306	MAVILOR MA/BL	MAVILOR BLS 05/07	BALDOR BSM	GETTY	ID 206
SMTB	CABLE							
Phase U	brown	L	F	A	1	1	B	B
Phase V	black	J	D	B	2	2	A	A
Phase W	blue	K	E	C	3	3	C	C
GND/Shield	yell/green	M	H	D	4		D	D
Ther. switch	black	D	B	H*	7*		E*	
Ther. switch	black	E	G	I*	8*		F*	
Brake +	red	-	A	E	5			
Brake -	black	-	C	F	6			

* These pins are in the resolver cable

10.6.1 Motor thermal sensor

For motors where the thermal sensor output is on the resolver connector, the thermal switch is connected to the X1 connector (terminals 1 and 2). On motors where the thermal switch output is on the power connector, the thermal switch can be connected via the back of the rack ..

On motors with an NTC thermal sensor, the amplifier configuration is the following: OP jumper closed and MN jumper open.

On motors with a PTC thermal sensor, the amplifier configuration is the following: MN jumper closed and OP jumper open.

10.6.2 Current loops

The adjustment of the current loop P.I. regulators according to the amplifier current and to the inductance between the motor terminals is as follows:

4A, 8A, 12A AND 17A AMPLIFIERS

Calculation of $G = 1.4 \times \text{Amplifier current (A)} \times \text{Inductance between phases (mH)}$,

- If $G < 60$, current loop jumpers on B3 position,
- If $60 < G < 100$, current loop jumpers on B2 position,
- If $G > 100$, current loop jumpers on B1 position.

30A, 45A AND 60A AMPLIFIERS

Calculation of $G = 1.4 \times \text{Amplifier current (A)} \times \text{Inductance between phases (mH)}$,

- If $G < 100$, current loop jumpers on B3 position,
- If $100 < G < 250$, current loop jumpers on B2 position,
- If $G > 250$, current loop jumpers on B1 position.

70A AND 100A AMPLIFIERS

Calculation of $G = 1.4 \times \text{Amplifier current (A)} \times \text{Inductance between phases (mH)}$,

Calculation of the RA, CA and C14 components of the current loops,

RA = G (K Ω), CA = 130 /G (nF), C14 = CA /G (nF).

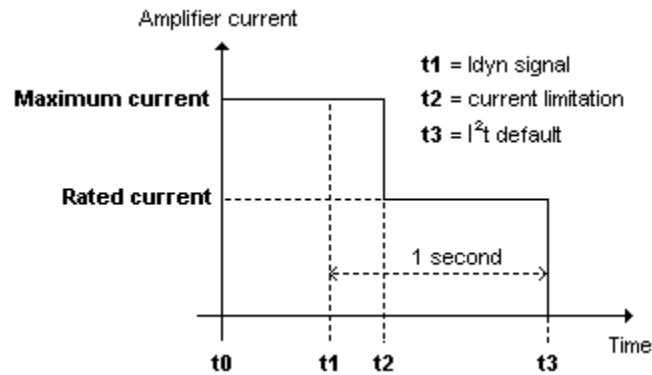
10.6.3 I²t protection

Current limitation in Fusing mode

When the amplifier RMS current (I^2t) reaches 85% of the Rated current, the Idyn signal output is activated and the I^2t error display flashes on the amplifier front panel. If the RMS current (I^2t) has not dropped below 85 % of the Rated current within 1 second, the I^2t default is released and the amplifier is disabled (otherwise, the Idyn signal and the flashing I^2t error display are both shut off).

When the amplifier RMS current (I^2t) reaches the **Rated current** value, the I^2t protection limits the amplifier current to this value.

The amplifier current limiting diagram in an extreme case (motor overload or blocked shaft) is shown below.



The maximum current duration before the **release** of the Idyn signal depends on the value of the **Rated current** and **Maximum current** parameters. This value is calculated as follows:

$$T_{\text{dyn}} (\text{second}) = t_1 - t_0 = 200 \times \frac{\text{Rated current} (\%)}{\text{Maximum current} (\%)}^2$$

The maximum current duration before the **limitation** to the rated current also depends on the value of the **Rated current** and **Maximum current** parameters. This value is calculated as follows:

$$T_{\text{max}} (\text{second}) = t_2 - t_0 = 240 \times \frac{\text{Rated current} (\%)}{\text{Maximum current} (\%)}^2$$

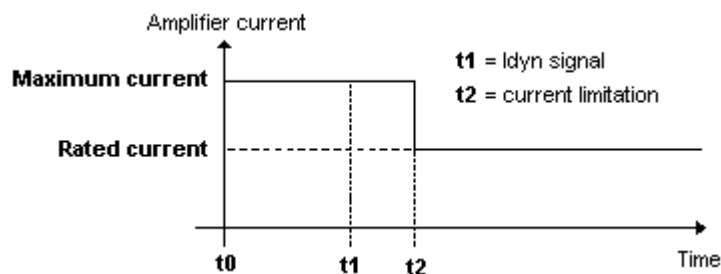
NOTE: When the **Maximum current** / **Rated current** ratio is close to 1, the values of T_{dyn} and T_{max} calculated above are below the real values. This formula remains very precise as long as **the Maximum current** / **Rated current** ratio is higher than 3/2.

Current limiting in **Limiting** mode

When the amplifier RMS current (I^2t) reaches 85% of the **Rated current**, the Idyn signal output is activated and the I^2t error display flashes on the amplifier front panel. When the RMS current (I^2t) drops below 85% of the Rated current, the Idyn signal and the flashing I^2t error display are both eliminated.

When the amplifier RMS current (I^2t) reaches the **Rated current** value, the I^2t protection limits the amplifier current to this value.

The amplifier current limiting diagram in an extreme case (motor overload or blocked shaft) is shown below.

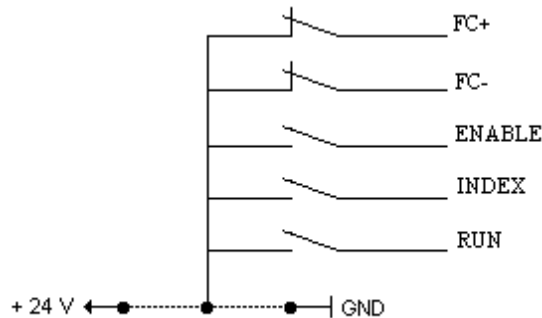


The maximum current duration before the **release** of the Idyn signal output ($t_1 - t_0$) and before rated current limiting ($t_2 - t_0$) is calculated the same way as for the **Fusing** mode.

10.7.0 Logic control adjustment

10.7.1 Positive or negative logic inputs

The logic inputs **FC +**, **FC -**, **ENABLE**, **INDEX** and **RUN** of the logic connector X4 can be configured in positive logic (control by +24 V) or in negative logic (control by 0 V) as described below:



POSITIVE LOGIC: E-F-G jumpers closed.
Input impedance: 10 K Ω .

Range: active at level $5 < V < 30$ V.
Response time: 500 μ s

NEGATIVE LOGIC: E-F-G jumpers open.
Input impedance: 10 K Ω .

Range: inactive or open at level $5 < V < 30$ V.
Response time: 500 μ s

Caution note

The five inputs (FC +, FC -, ENABLE, CI, CV0) of the X4 connector **must** all be in positive logic, or all in negative logic.

10.7.2 “Amp ready” and “Power ready” outputs

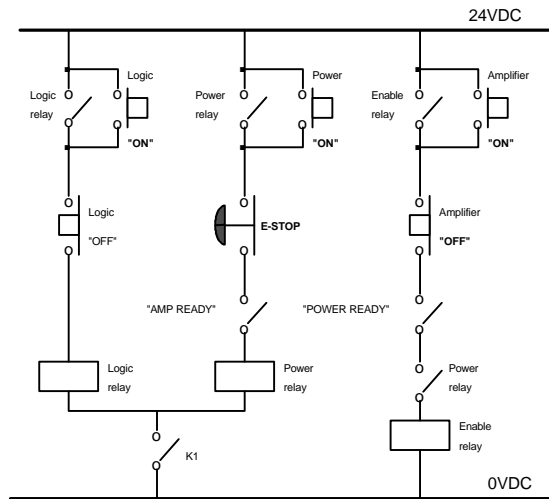
If the position references have to be kept when a stored fault is released on the amplifier or when the power supply is shut down or interrupted, it is possible:

- to reset the defaults via pin 13 of X4 without interrupting the logic supply,
- to have a logic supply which is independent of the power supply (auxiliary supply) in order to be able to cut the power supply without cutting the logic supply.

If the amplifier has an auxiliary supply on the PR8 connector, which is independent of the power supply, the J K L jumpers on the logic board allow the **Undervolt** default when switching on the auxiliary supply before switching on the main power supply.

JK jumper closed and KL jumper open. With the auxiliary supply applied before the main power supply, the "Undervolt." default is displayed and can hide a default of lower priority. The "AMP READY" and "POWER READY" outputs are both inactive (contact is open) until the power supply is on.

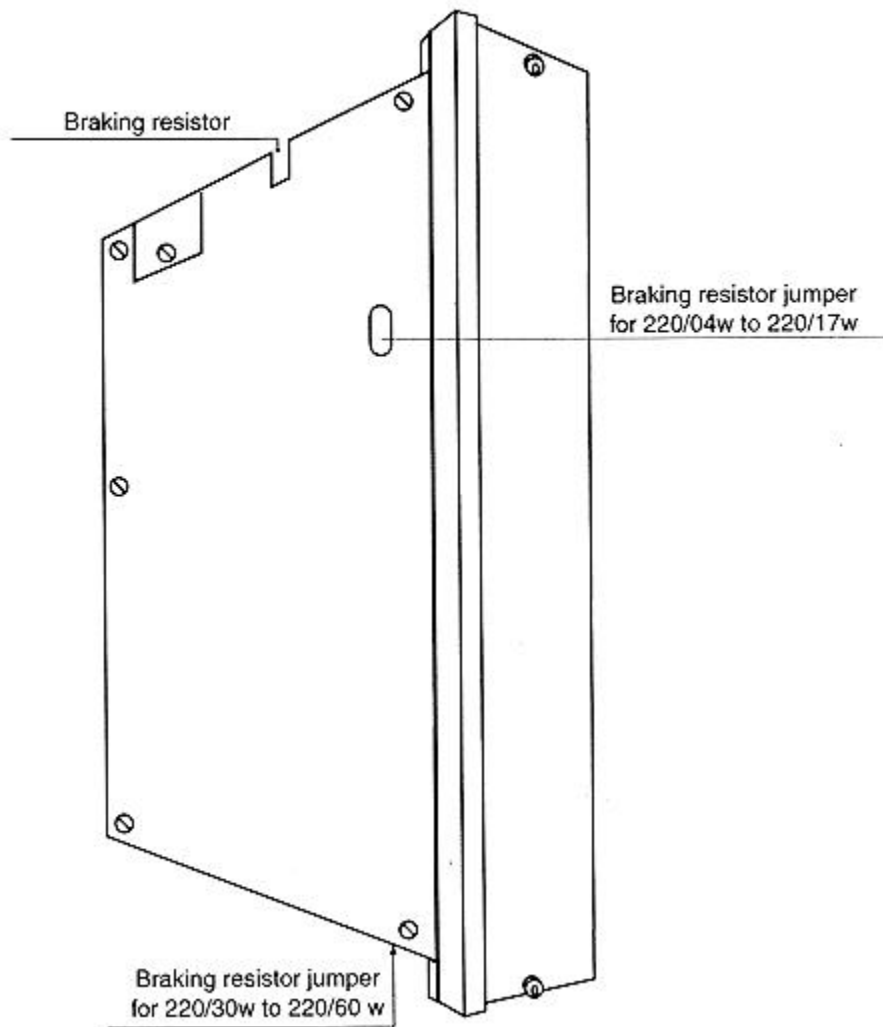
JK jumper open and KL jumper closed. The "Undervolt." default is inhibited when turning on the auxiliary supply before switching on the main power supply. The "AMP READY" output is then active and "POWER READY" remains inactive (contact open) until the main power supply is on. In this case, the amplifier control must have the following relay logic:



Amp ready
Power ready
Power relay
Logic relay
ENABLE relay
K1

Amp ready signals of all axis
Power ready signals of all axis
 Relay for power ON
 Relay for logic ON
 Servo control relay
 Auxiliary contact of the main isolation switch

10.8.0 Braking resistor system settings



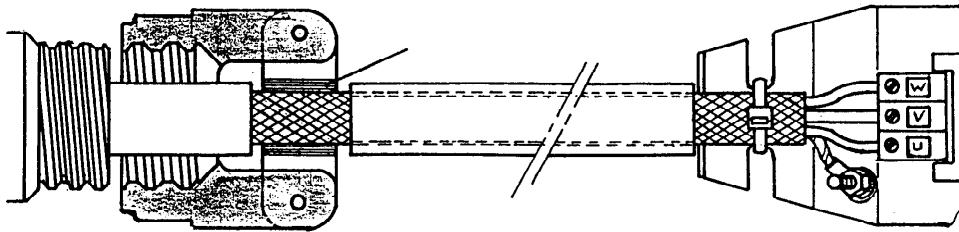
SMTBM-20A single axis: Braking resistor jumper **closed**
RBF rack: Braking resistor jumper **open**

CAUTION: The braking resistor selection is only available with the “w” referenced amplifiers

10.9.0 360° shield on the connectors

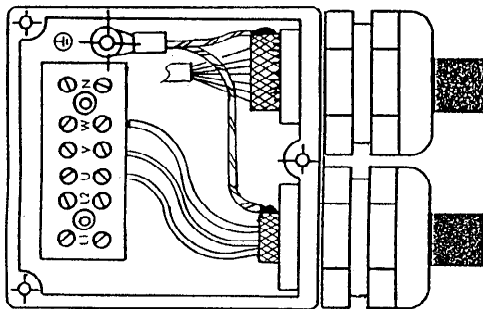
There must never be a shield interruption on the whole cable length.

Self-sticking copper ribbon if necessary for increasing the shield diameter to get properly tightened under the clamp



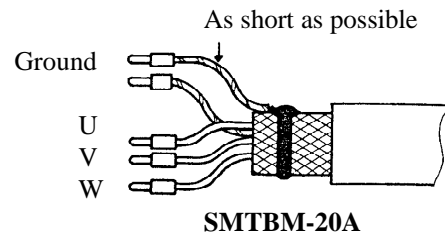
**Connector on MAVILOR
motor for resolver and motor**

RBF RACK



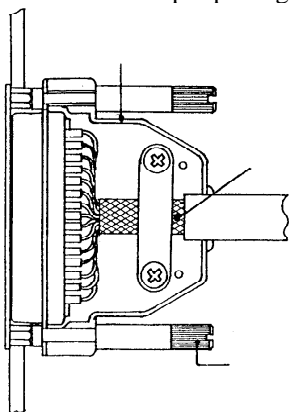
The cable can be soldered on the shield because the connector box is metallic
This solution does not correspond exactly to the IEC requirements, but it is acceptable

Connector box on the MAVILOR motor



**Metallic or metal plated plastic
Sub-D pin package**

SMTBM-20A



360 degrees shield ensured by the tightening clamp

The fastening screw must be tightened in order to ensure the shield continuity on the amplifier housing

Sub-D connector

Note: When the 360 degrees shield is made by means of a clamp, it is not necessary to connect a wire to the appropriate pin on the Sub-D connector