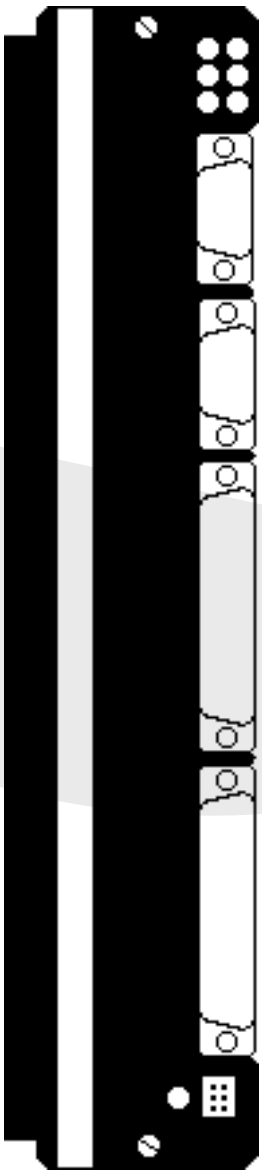
INFRANOR
SERVO DRIVES & MOTION CONTROL

SMT-BD1/g

gb



Registration applications with SMT-BD1/g drive

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IMPORTANT NOTE

This manual is describing a series of positioning servo amplifiers having output capability for driving AC brushless servo motors. This manual must be used in ***conjunction*** with the SMT-BD1 manual and ***cannot be dissociated from it***.
The conditions and recommendations of use as well as the responsibility and warranty restrictions mentioned in the SMT-BD1 manual are also valid for the present amplifier version **SMT-BD1/g**.

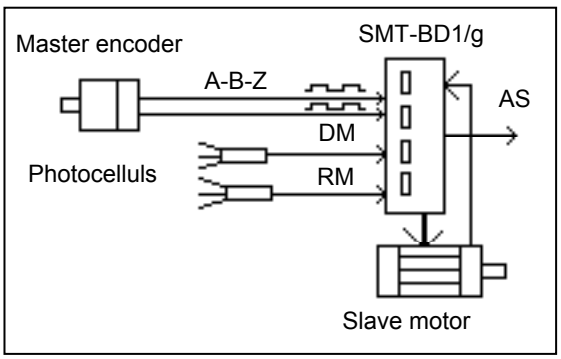
Issue: **3.0**

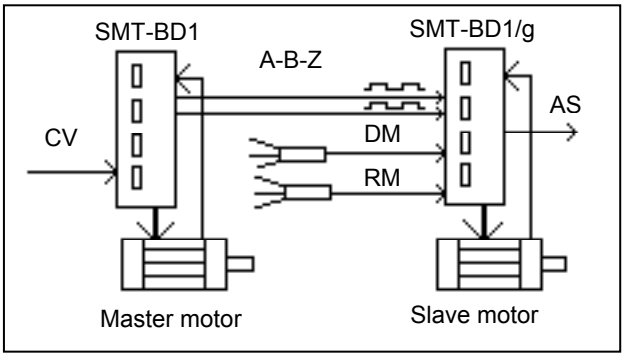
Content

Chapter 1 – General description

1 - INTRODUCTION

Product registration applications require the **SMT-I4-BD1** daughter board and the **X.X5** EEPROM version on the **SMT-BD1** amplifier. In this configuration, the **SMT-BD1/g** amplifier controls the motor shaft position with regard to the master axis position and the position of the products to be registered. The master axis position is received as two differential encoder signals **A**, **/A** and **B**, **/B** in quadrature. These signals are entered on the amplifier position connector **X2**. This input type allows a direct interfacing with an encoder mounted on the master axis or with the encoder output of an amplifier that controls the master motor. Both configurations with master encoder and master amplifier are shown below.





The photocell connected to the **DM** input of the amplifier **X2** connector allows the detection of the master axis reference positions. The photocell connected to the **RM** input of the **X2** connector allows the position detection of the products to be registered for the position interval calculation. The **AS** analog output of the amplifier **X4** connector provides a motor speed monitor sized between +/- 10 V.

The reduction ratio between both master and slave axes is defined with regard to the encoder resolutions of each axis. The slave motor encoder resolution is programmable between 1 and 8192 ppr. The product pitch is programmable between 100 and 16 000 encoder edges.

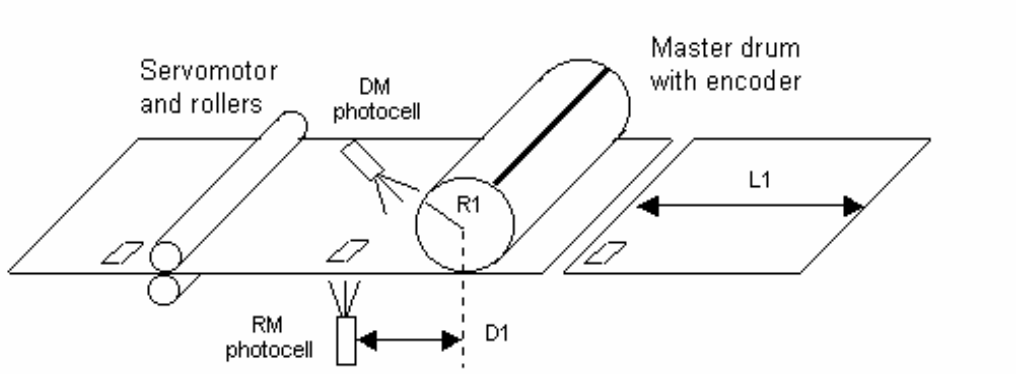
When the slave motor is not controlled (**ENABLE** input disabled), the master axis encoder pulses are not counted. When enabling the **ENABLE** input, the slave motor is position controlled and follows the master axis pulses. The product position interval is measured by the **RM** and **DM** photocells. This interval is then corrected by the slave motor in order to keep the pitch value between the products. If the pitch cannot be kept because of too large a correction distance or because the motor speed reaches its limit, then the logic output **REG** is disabled until the pitch is correct again. When the motor following error exceeds the limit value programmed, the **POS** logic output is then disabled.

The **BPCW** software including many application modules (material registration, conveyor registration, rotating cam) allows a quick amplifier parameter setting according to the target application.

2 - APPLICATIONS

2.1 - MATERIAL AND DRUM REGISTRATION

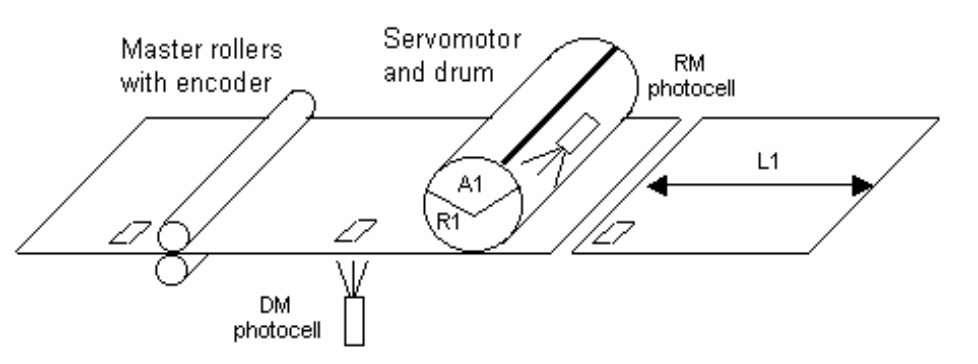
The **SMT-BD1/g** amplifier can be used for the control of a continuous material running with regularly spaced synchronization marks. This kind of applications can be met in the printing industry or in rotating cutting, as shown below.



In this case, the registration control allows to compensate the material slippages and the interval variations between the registration marks, in order to keep the drum position always aligned on the synchronization marks.

2.2 - ROTATING CAM

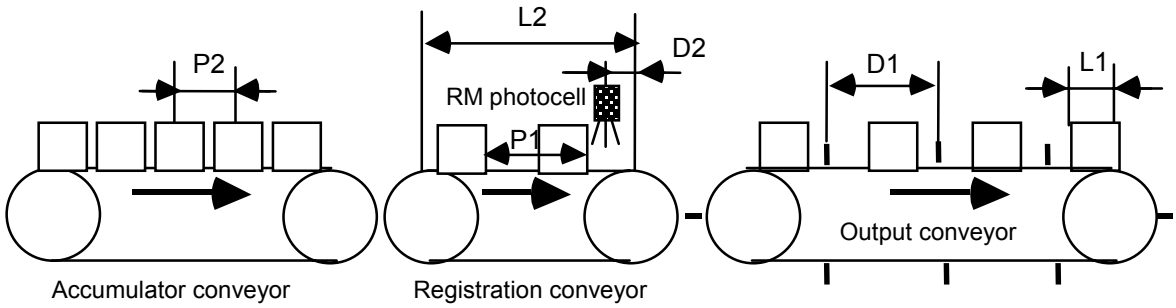
The **SMT-BD1/g** amplifier can be used for a rotating CAM application with regularly spaced synchronization marks. This kind of application can be met in the printing industry or in rotating cutting, as shown below.



In this case, drum and material must be synchronized for a given distance according to the material registration marks and the drum photocell position.

2.3 - CONVEYOR REGISTRATION

The **SMT-BD1/g** amplifier can be used for the control of conveyors carrying products, as shown below.



In this case, the registration control allows a regular spacing of the products with their placing in the output conveyor boxes, in spite of their irregular spacing on the input conveyor.

3 - OPERATION

3.1 - OPERATION MODES

Two operation modes are available for the product registration in order to fit various kinds of applications.

a) Bidirectional registration

In this case, when the product to be registered has a lead over the synchronization mark, the motor can run back in order to cancel this lead.
This operation mode is suited to the registration of a material equipped with regularly spaced synchronization marks, with possible reversal of the running direction during the operation.

b) Unidirectional registration

In this case, the motor cannot run back and the registration is made in just one single displacement direction. When the encoder is running back of more than half a pitch, the **POS** logic output is disabled and the amplifier inhibited.
This operation mode is well-suited to applications with conveyor feeding. When a product has a lead over its reference position on the output conveyor, the registration conveyor is stopped in order to cancel this lead.

3.2 - PRODUCT REFERENCE

The product reference is chosen according to the application, as described below.

a) Relative product reference

Each product detected by the **RM** photocell is registered with regard to the preceding product. The series origin corresponds to the first product detected by the **RM** photocell after the amplifier enabling by activation of the **ENABLE** input.

b) Product reference on the master encoder marker pulse

Each product detected by the **RM** photocell is registered with regard to the reference position given by the master encoder marker pulse. The master encoder resolution must then be a whole multiple of the product reference pitch defined in the amplifier. The reference positions given by the master encoder marker pulse can be "electronically" shifted of +/- half a pitch by means of the +/- 10 V analog voltage applied to the **DS** input of the **X4** control connector.

c) Product reference on the **DM** logic input

Each product detected by the **RM** photocell is registered with regard to the reference position given by the activation of the **DM** logic input. The spacing between the **DM** reference marks must then be a whole multiple of the product reference pitch defined in the amplifier. The reference positions given by the activation of the **DM** logic input can be « electronically » shifted of +/- half a pitch by means of the +/- 10 V analog voltage applied to the **DS** input of the **X4** control connector.

3.3 - ORIGIN ACQUISITION

Two origin acquisition modes can be used in the case of a product reference on the master encoder marker pulse or on the **DM** logic input.

a) On-line origin acquisition

After the activation of the amplifier **ENABLE** input, the motor follows the master axis position. The first reference position is taken on the reference sensor acquisition (master encoder marker pulse or **DM** logic input). Then, all products detected by the **RM** photocell are registered with regard to the reference positions.

b) Origin acquisition with stopping on the first product

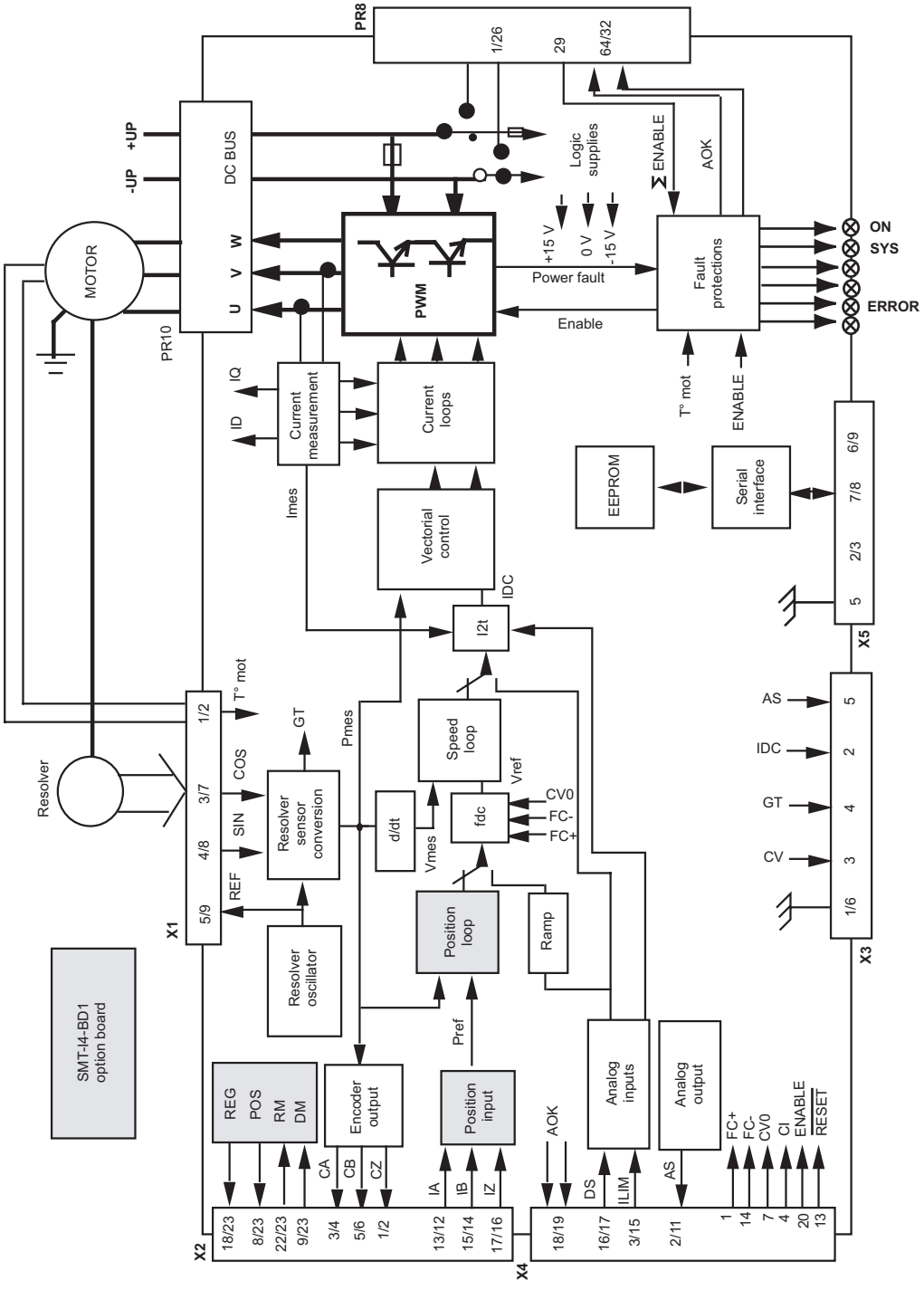
After the activation of the amplifier **ENABLE** input, the motor follows the master axis position and stops at the detection of the first product by the **RM** photocell. This first product will then be registered at the next reference sensor activation (master encoder marker pulse or **DM** logic input). It is possible to define this way an absolute origin of the product series at the reference sensor activation.

Chapter 2 – Specifications

1 - TECHNICAL DATA

Position measurement input of the master axis	Two encoder pulse trains A and B with marker pulse. Max. frequency = 250 kHz RS422 line receiver
Programmable product reference pitch	100 to 16 000 encoder edges
Reduction ratio between master and slave axes	Master encoder resolution / Slave encoder resolution
Programmable slave motor encoder resolution	Max. 8 192 ppr up to 900 rpm Max. 4 096 ppr up to 3 600 rpm Max. 1 024 ppr up to 14 000 rpm
Amplifier position repeatability	1 encoder edge
Amplifier position accuracy	8 arc minutes + 1 encoder edge in standard (2 arc minutes + 1 encoder edge optional) Note: The final position accuracy must take into account the resolver accuracy.
PIV + Feedforward position regulator	Sampling period: 0,5 ms Integrator anti-wind-up system Adjustable digital gains Antiresonance filter
Position loop bandwidth	Adjustable cut-off frequency for 45° phase shift: 50, 75 or 100 Hz
Logic inputs	RM: Product detection signal on positive edge DM: Reference detection signal on positive edge Quick acquisition: 50 µs Anti-resilience filter: 200 Hz
Logic outputs	POS: Position following OK if active REG: Registration OK if active
Analog input	DS: Reference positions shift
Analog output	AS: Accumulator speed input command

2 - AMPLIFIER BLOCK DIAGRAM



3 - STORED PROTECTION

The stored fault can be reset by:

- the RESET function of the **BPCW** software,
- via the fault RESET input of the X4 connector, pin 13,
- by switching off the amplifier.

PROTECTION	DISPLAY CODE	LED
Position following error	Position	o o o o

Chapter 3 – Inputs-Outputs

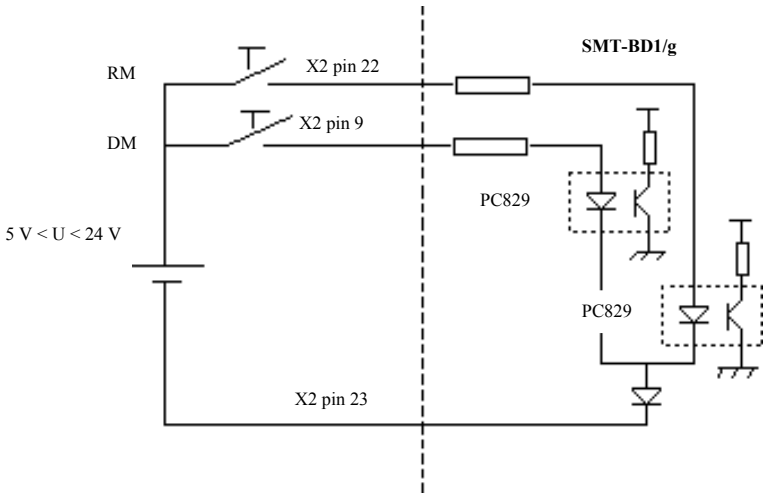
1 - X2 : POSITION CONNECTOR

1.1 - PINS ALLOCATION

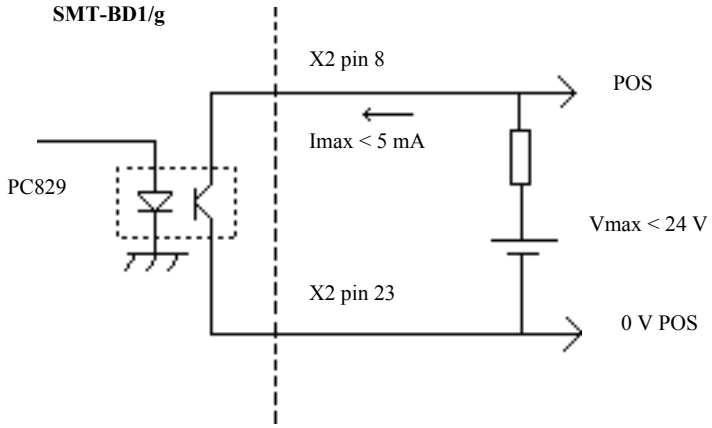
Pin	Function	I / O	REMARKS
1	CZ/	O	Marker pulse/ of the motor encoder output (max. 5 V, 20 mA)
2	CZ	O	Marker pulse of the motor encoder output Recommended receiver: 26LS32
3	CA/	O	Channel A/ of the motor encoder output (max. 5 V, 20 mA)
4	CA	O	Channel A of the motor encoder output Recommended receiver: 26LS32
5	CB/	O	Channel B/ of the motor encoder output (max. 5 V, 20 mA)
6	CB	O	Channel B of the motor encoder output Recommended receiver: 26LS32
7,10,11	0 V		GND
12	IA/	I	Channel A/ of the master encoder input (5 V, consumption: 2 mA)
13	IA	I	Channel A of the master encoder input Recommended driver: 26LS31
14	IB/	I	Channel B/ of the master encoder input (5 V, consumption: 2 mA)
15	IB	I	Channel B of the master encoder input Recommended driver: 26LS31
16	IZ/	I	Marker pulse of the master encoder input (5 V, consumption: 2 mA)
17	IZ	I	Marker pulse of the master encoder input Recommended driver: 26LS31
22	RM	I	RM logic input: Product detection signal on positive edge
9	DM	I	DM logic input: Reference detection signal on positive edge
18	REG	O	REG logic output: Registration OK if active
8	POS	O	POS logic output: Position following OK if active
23	0 V I/O		O V of logic inputs/outputs
19,20,21	Reserved		Reserved
24	+ 5 V	O	+/- 5 % 300 mA available with 5 V jumper closed
25	0 V		Master encoder (if required)

1.2 - SPECIFICATION OF THE LOGIC INPUTS/OUTPUTS

The RM and DM inputs are "optocoupled" inputs and operate in positive logic on the signal rising edge as shown below. The input voltage corresponds to level 1 and is between 5 V and 24 V.



The POS and REG outputs are "open collector" and "optocoupled" outputs. The transistor is open if a fault occurs. The traditional application scheme is shown below. The maximum output current is 5 mA.



2 - X3: TEST CONNECTOR

Pin	Function	REMARKS
1 -6	0 V	
2	DAC 1 output	IDC signal ±10 V, resolution: 8 bits, linearity: 2 % (10 V for amplifier current rating)*
3	CV speed input command	±10 V for ± max. speed
4	GT speed monitor	±8 V for ±14 000 rpm
5	DAC 2 output	AS signal ±10 V, resolution: 8 bits, linearity: 2 %* (10 V for max. motor speed)

* Linearity = 10 % for logic boards 01612A, 01612B and 01612C.

3 - X4: CONTROL CONNECTOR

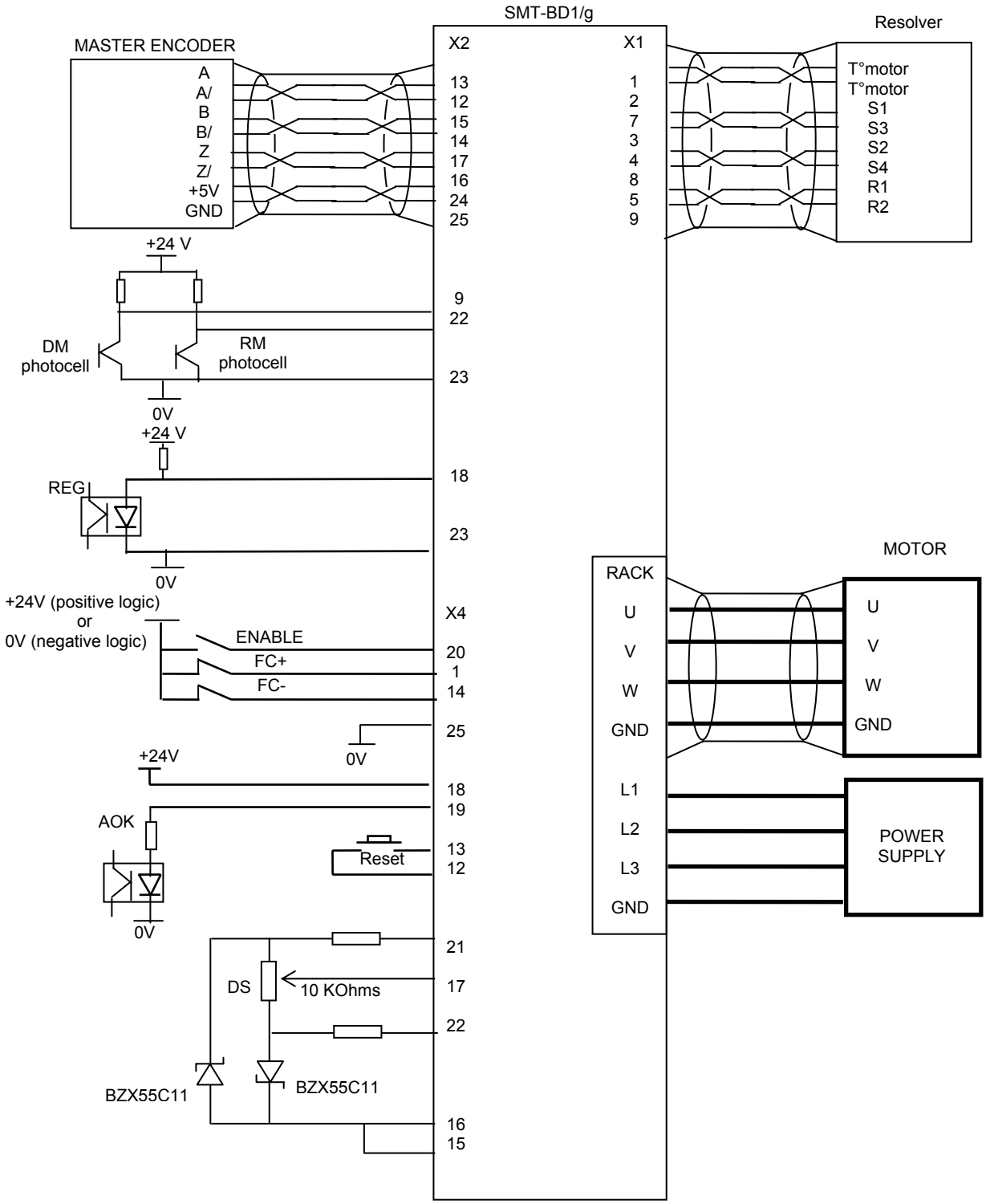
Pin	Function	I/O	REMARKS
2	AS output	O	Accumulator reference output
11	GND		±10 V, resolution: 8 bits (10 V for max. motor speed)
17	+DS input	I	Reference positions shift
16	- DS input	I	±10 V for ± 1/2 pitch
15	GND		
21	+15 V	O	50 mA available
22	-15 V	I	50 mA available

For the other pins allocations of the X4 control connector, see standard manual SMT-BD1.

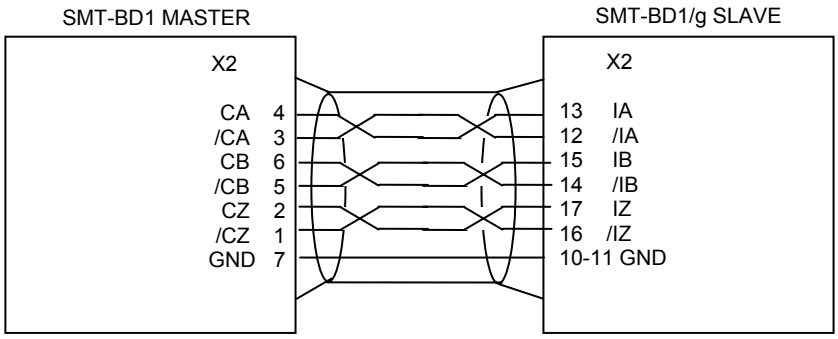
Chapter 4 – Connections

1 - CONTROL CONNECTION DIAGRAM

1.1 - CONNECTION WITH THE MASTER ENCODER



1.2 - CONNECTION WITH A MASTER AMPLIFIER



An SMT-BD1 master amplifier can supply up to 10 SMT-BD1/g slave amplifiers.

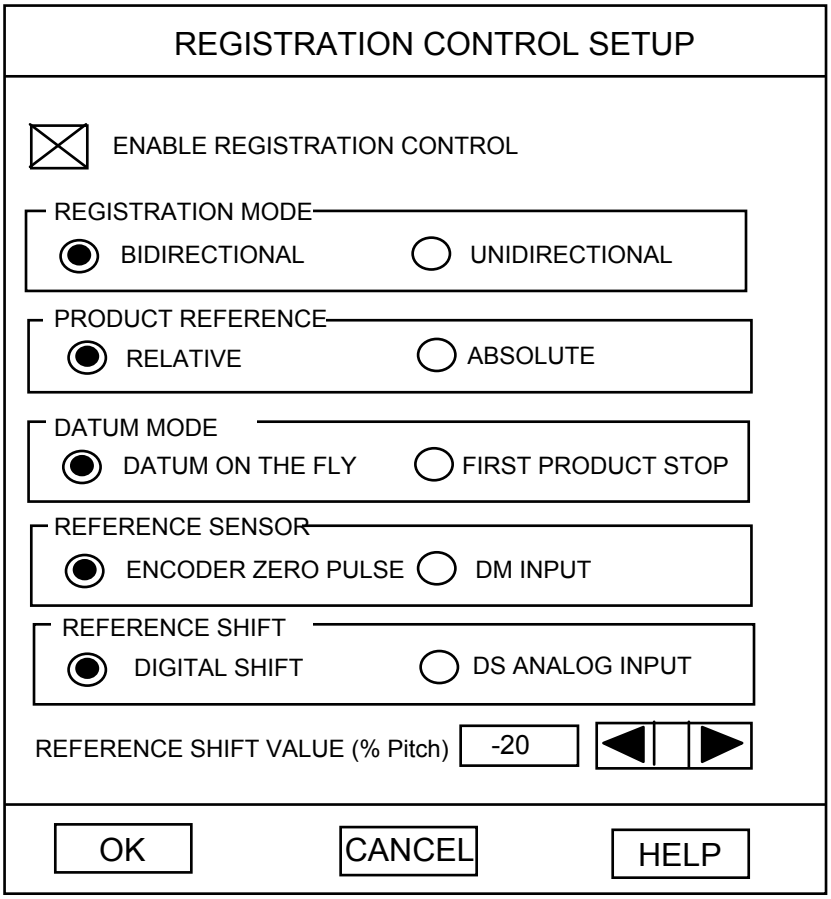
2 - WIRING REQUIREMENTS

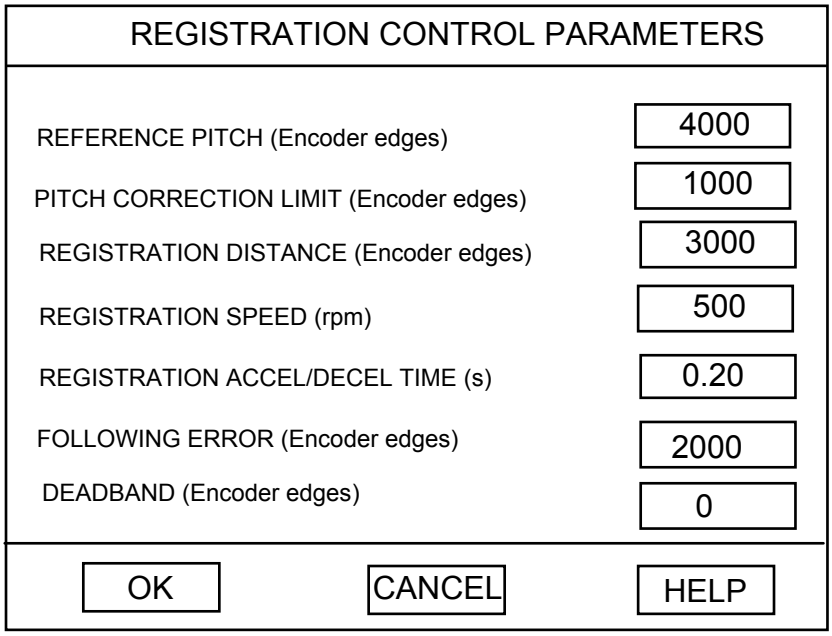
For the incremental position input command signals A, B and Z of the master-slave connection, use a cable with a **360° shield connection by means of the metallic connectors** at both cable ends (see Chapter 8, section 6 of the SMT-BD1 standard manual). **Connect also together the 0 V of both amplifiers** (pin **GND** of the X2 connector). The crossing of the **A** and **B**, **A** and **A/** or **B** and **B/** signals on the incremental position input command reverses the slave motor rotation direction with regard to the master axis.

For the other connection cables, see wiring instructions in Chapter 4, section 2 of the standard **SMT-BD1** manual.

Chapter 5 – Adjustable parameters

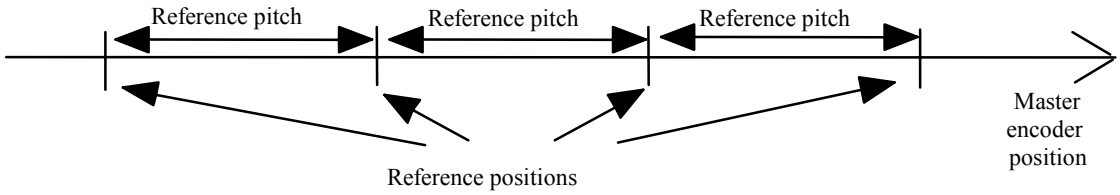
The specific Registration parameters are accessible via the **Registration control setup** and **Registration control parameters** submenus of the **Advanced functions** menu, in the **BPCW** software version 2.6 and higher.





1 - OPERATION MODE

The Registration operation requires the selection of the **Enable Registration Control** function in the **Registration Control Setup** submenu (**Advanced Functions** menu of the **BPCW** software, version **2.6** and higher). The amplifier controls the slave motor shaft position with regard to the master axis position and the position of the products to be registered. The master axis position is received as two differential encoder signals on the **X2** connector. The spacing between the products to be registered is measured by the **RM** photocell that is also connected on the **X2** connector. The reference positions are calculated as shown below.



At each activation of the **RM** input, the **SMT-BD1** amplifier calculates the position error between the product to be registered and the current master axis reference position. This error is then corrected by a relative displacement of the slave motor with regard to the master axis, according to a trapezoidal speed profile. The maximum correction distance is limited at the value of the **Pitch correction limit** parameter. When the product cannot be registered because the correction distance exceeds the **Pitch correction limit** parameter or because the slave motor speed reaches its limit during the correction displacement, the **REG** logic output is disabled until the pitch is correct again.

2 - APPLICATION PARAMETERS

The **Encoder resolution** parameter is accessible in the **ENCODER RESOLUTION** module of the **BPCW** adjustment panel. It defines the encoder resolution corresponding to one revolution of the slave motor. The limit value of this parameter according to the maximum motor speed (**Maximum speed**) is indicated in the table below.

MAX. SPEED (rpm)	900	3 600	14 000
MAX. ENCODER RESOLUTION	8 192	4 096	1 024

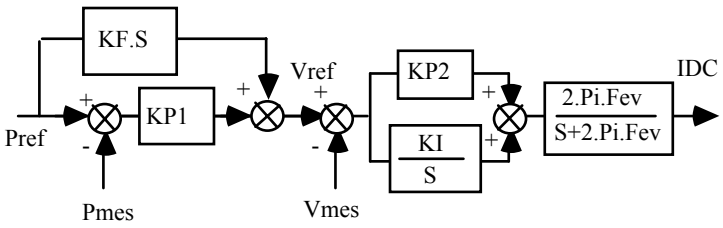
The **Accel/Decel time (s)** parameter is accessible in the module **ANALOG INPUT** of the **BPCW** adjustment panel. It defines the acceleration and deceleration time between 0 and the maximum motor speed (**Maximum speed**) for an origin acquisition with stopping on the first product (**Product reference = Absolute** and **Datum mode = First product stop**).

The Registration configuration parameters are accessible via the **Registration Control Setup** submenu (**Advanced Functions** menu of the **BPCW** version **2.6** and higher). The **Help** key allows the access to the comments regarding the window parameter definition.

The Registration adjustment parameters are accessible via the **Registration Control Parameters** submenu (**Advanced Functions** menu of the **BPCW** version **2.6** and higher). The **Help** key allows the access to the comments regarding the definition of the window parameters.

3 - POSITION REGULATOR PARAMETERS

The structure of the regulator used in **Registration Control** mode is shown below.



All regulator parameters are accessible via the **Controller parameters** function of the **Advanced Functions** menu.

The parameter **Speed error low-pass filter** sets the cut-off frequency at - 3 db (Fev) of the first order filter acting on the speed error. The value of this parameter depends on the selected bandwidth.

The parameter **Proportional speed gain** defines the proportional gain (KP2) of the regulator acting on the speed error. The adjustment range is between 0 and 4 095.

The parameter **Integral 1 speed gain** defines the integral gain (KI) of the regulator acting on the speed error. The adjustment range is between 0 and 255.

The parameter **Proportional position gain** defines the proportional gain acting on the position error (KP1). The adjustment range is between 0 and 1.

The parameter **Feedforward position gain** defines the amplitude of the feedforward term (KF) corresponding to the speed input command (position input command derivation). This feedforward term allows to reduce the following error during the motor acceleration and deceleration phases. The adjustment range is between 0 and 1.

All these gain parameters are automatically calculated during the execution of the **AUTO-TUNING** procedure.

Chapter 6 – Commissioning

1 - CHECKING THE CONFIGURATION

Check the amplifier standard configuration as described in Chapter 6 of the standard **SMT-BD1** manual.

Check for the presence of the **SMT-I4-BD1** daughter board between both logic and power boards (see chapter 8: Hardware location diagram).

Check for the EPROM version that must be **X.X5**.

If using an external encoder for the master motor, check that the **5 V** jumper is correctly made on the logic board for the encoder supply (see Chapter 8: Hardware location diagram).

Check that the **E** and **S** jumpers are open on the amplifier logic board.

2 - POWERING OF THE AMPLIFIER

Turn on the amplifier as described in Chapter 6 of the standard **SMT-BD1** manual.

3 - AMPLIFIER STARTING AND ADJUSTMENT

Start and adjust the amplifier by means of the **BPCW** software, as described in Chapter 6 of the standard **SMT-BD1** manual.

Select the **PI^2** speed regulator before executing the **AUTO-TUNING** procedure in the **CONTROLLER** module.

Check, in manual control (**MANUAL**), the motor adjustment stability by entering a speed input command in the **Reference** box of the **SPEED** module of **BPCW**.

In case of loud noise in the motor at standstill and when running, check the rigidity of the transmission chain between motor and load (backlashes and elasticities in gearboxes and couplings).

If required, start again the **AUTO-TUNING** procedure by selecting a lower bandwidth (**Bandwidth = Medium** or **Low**). If the problem remains, renew the **AUTO-TUNING** procedure by activating the anti-resonance filter (**Filter = Antiresonance**). The antiresonance filter is accessible in the **BPCW** version **2.6** and up and the amplifier EPROM version **5.7** and higher.

4 - REGISTRATION APPLICATION SETUP

4.1 - REGISTRATION CONFIGURATION

Enter the module **Registration control setup** accessible in the menu **Advanced functions** and select the function **Enable registration control**.

Select the registration mode **Bidirectional** or **Unidirectional** in the box **Registration mode**.

Select the absolute product reference (**Product reference = Absolute**) if the material has got synchronization marks that must be aligned. Otherwise, select the relative product reference (**Product reference = Relative**).

When choosing an absolute product reference (**Absolute**), select the origin acquisition mode in the box **Datum mode** and select the reference sensor **DM input** or **Encoder marker pulse** in the box **Reference sensor**.

Quit the window **Registration control setup** by means of the **OK** key.

4.2 - REGISTRATION PARAMETERS

Display the appropriate application module accessible in the menu **Advanced functions** of the **BPCW** software (continuous material registration, conveyor registration, rotating drum registration or rotating cam). The **Help** key allows the access to the comments regarding the parameters definition of the window.

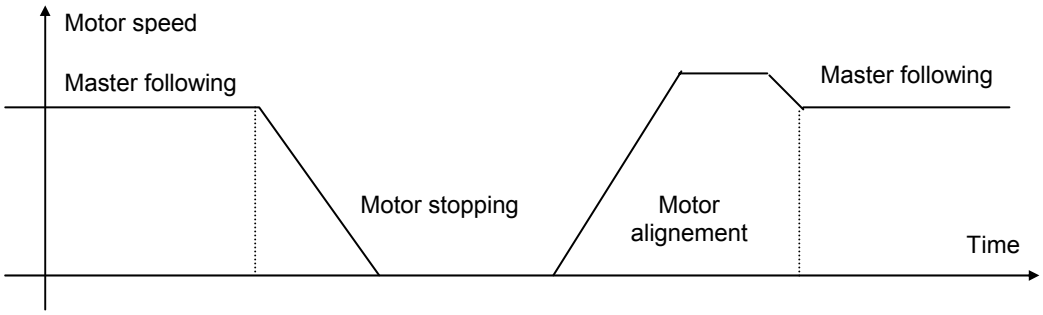
Initialize the application parameters in the upper part of the window and click on the **Calculation** key for obtaining the value of the amplifier parameters adjustment in the lower part of the window.

Quit the application module by means of the **Send parameters** key in order to send the adjustment parameters in the amplifier. Otherwise, leave the window by the **Cancel** key.

All these adjustment parameters can then be displayed and modified in the window **Registration control parameters** of the **Advanced functions** menu.

4.3 - ADJUSTMENT FOR ORIGIN ACQUISITION

This adjustment is only useful if the absolute origin acquisition mode with stopping on the first product has been selected (**Product reference** = **Absolute** and **Datum mode** = **First product stop**). In this case, the origin acquisition is described below.



Display the module **Absolute datum adjustment** accessible in the **Advanced functions** menu of the **BPCW** software. The **Help** key allows the access to the comments regarding the parameters definition of the window.

After the parameters initialization in the upper part of the **Absolute datum adjustment** window, click on the **Calculation** key for obtaining the amplifier adjustment parameters in the lower part of the window.

Check that the value of the parameter **Minimum photocell distance** is smaller or equal to the adjustment distance value of the photocell on the machine. Otherwise, reduce the value of the parameter **Maximum line speed for datum** and click on the **Calculation** key for obtaining the new adjustment parameters.

Quit the module **Absolute datum adjustment** by means of the **Send parameters** key in order to enter the adjustment parameters in the amplifier. Otherwise, quit the window by means of the **Cancel** key.

4.4 - STARTING WITH A RUNNING MATERIAL APPLICATION

Remove the material and disable the **RM** photocell.

Activate the **ENABLE** input and check the motor displacement by moving manually the master encoder. If required, reverse the motor rotation direction with regard to the encoder by using the function **Reverse movement** in the **Analog input** module.

Engage the material on the machine and release the **RM** photocell.

Start the machine at low speed and check the material output pitch. When selecting an absolute product reference (**Product reference** = **Absolute**), check the correct tool alignment with the material marks. If it is not correct, proceed as follows:

1st solution

- Select the function **Digital shift** in the box **Reference shift** of the module **Registration control setup** and confirm by the **OK** key.

- Enter again the window **Registration control setup** and modify progressively the value of the parameter **Reference shift value** during the material running until the correct tool alignment with the marks.

Remark: If modifying the position of the **RM** and **DM** photocells, this alignment must be made again.

2nd solution

- Wire the analog **DS** input as described in chapter 4, section 1.1.

- Select the function **DS analog input** in the box **Reference shift** of the module **Registration control setup** and confirm with **OK** key.

- Modify progressively the voltage value applied on the **DS** input by means of the potentiometer during the material running until the correct tool alignment with the marks.

Note: If modifying the position of the **RM** and **DM** photocells, this alignment must be made again.

Increase the line speed up to its maximum value and check that the material pitch and the tool alignment with the marks are still correct.

Check the value of the motor following error (**Pos err**) during the operation and adjust the following error threshold (**Following error**) at its lowest value in order to avoid a triggering of the **Position** error during the normal duty cycle.

4.5 - STARTING WITH A CONVEYOR APPLICATION

Start and adjust the **SMT-BD1** accumulator amplifier by means of the **BPCW** software as described in chapter 6 of the standard **SMT-BD1** manual.

Wire the speed input command of the **AS** accumulator as described in chapter 4, section 1.1.

Make the offset compensation on the **SMT-BD1** accumulator amplifier with the **SMT-BD1/g** registration conveyor amplifier switched on and disabled (registration motor at standstill).

Enter the value of the parameter **Accumulator maximum speed** calculated before in the parameter **Maximum speed (rpm)** of the **Analog input** module on the **SMT-BD1** accumulator amplifier. Check that the value of the **Accel/decel time (s)** parameter of the **SMT-BD1** accumulator amplifier is equal to zero.

Store the adjustment parameters in the **EEPROM** of the **SMT-BD1** accumulator amplifier.

Remove the products from the machine conveyors and disable the photocell **RM** input.

Activate the **ENABLE** input and check that both registration and accumulator conveyors correctly follow the output conveyor. If required, reverse the motor rotation direction with regard to the encoder by means of the function **Reverse movement** of the **Analog input** module of **BPCW**.

Check the correct speed ratio between the conveyors.

Release the photocell **RM** input and check its commutation polarity (rising edge on **RM** input at the product detection) by proceeding as follows:
- Drive the registration conveyor at low speed by means of the master encoder and engage a product on the registration conveyor.
- Check that the conveyor correction movement is made directly at the product detection by the photocell and not when the product has already passed the photocell.
- If the photocell signal polarity is not correct (rising edge on **RM** input after the product has gone by), reverse the photocell commutation adjustment (bright / dark).

Engage the products to be registered on the machine.

Start the output conveyor at low speed and check that the products output pitch is correct as from the detection of the first product. When selecting an absolute product reference (**Product reference** = **Absolute**), check that the products are correctly placed in the output conveyor boxes. If it is not correct, proceed as follows:

1st solution

- Select the function **Digital shift** in the box **Reference shift** of the module **Registration control setup** and confirm by the **OK** key.

- Enter again the window **Registration control setup** and modify progressively the value of the parameter **Reference shift value** with the conveyors running until the correct product alignment in the output conveyor boxes.

Note: If modifying the position of the **RM** photocell or of the reference sensor (**DM** or **Encoder marker pulse**), this alignment must be made again.

2nd solution

- Wire the analog **DS** input as described in chapter 4, section 1.1.

- Select the function **DS analog input** in the box **Reference shift** of the module **Registration control setup** and confirm with **OK** key.

- Modify progressively the voltage value applied on the **DS** input by means of the potentiometer during the material running until the correct product alignment in the output conveyor boxes.

Note: If modifying the position of the **RM** photocell or of the reference sensor (**DM** or **Encoder marker pulse**), this alignment must be made again.

Increase the output conveyor speed up to its maximum value and check that the pitch between the products and their alignment in the output conveyor boxes are still correct.

Check the value of the motor following error (**Pos err**) during the operation and adjust the following error threshold (**Following error**) at its minimum value in order to avoid a triggering of the **Position** error during the normal duty cycle.

Chapter 7 - Troubleshooting

1 - POSITION FOLLOWING ERROR (POS)

Increase the value of the parameter **Following error** in the menu **Registration control parameters** accessible in the module **Advanced functions**.

Check that the slave motor speed does not reach the maximum speed defined by the parameter **Maximum speed** of the **Analog input** module. In this case, increase the maximum motor speed defined by the parameter **Maximum speed** or reduce the master axis speed.

Check that the **IDC** current input command of the slave motor does not reach the maximum value defined by the parameter **Maximum current** of the **Current** module. In this case, increase the motor parameter **Maximum current** or increase the master axis acceleration and deceleration times.

In unidirectional mode (**Registration mode** = **Unidirectional**), check for no reversal of the master axis displacement direction.

If the fault occurs when the first product is stopping in absolute initialization mode (**Absolute**) with **Datum mode** = **First product stop**, reduce the conveyors speed during the origin acquisition procedure.

If the fault occurs when the slave motor is starting or stopping in unidirectional registration mode (**Registration mode** = **Unidirectional**), reduce the motor accelerations and decelerations during the starting or stopping phases.

2 - REGISTRATION ERROR (REG)

Check that the maximum value of the product pitch error can be compensated by the adjustment of the registration parameters. Otherwise, renew the adjustments in the menu **Advanced functions**.

Check that the slave motor speed does not reach its limit during the correction trajectory. Otherwise, increase the maximum motor speed defined by the parameter **Maximum speed** of the module **Analog input** or reduce the master axis speed.

3 - OPERATION PROBLEMS

3.1 - LOUD CRACKLING NOISE IN THE MOTOR AT STANDSTILL

Check that the Motor-Amplifier-Controller ground connections answer the requirements of Chapter 4.
Check that the wiring of the incremental position input command answers the requirements of Chapter 4.

3.2 - LOUD NOISE IN THE MOTOR AT STANDSTILL AND WHEN RUNNING

Check the rigidity of the mechanical coupling between motor and load (backlashes and elasticities in the gearboxes and couplings). If required, execute again the **AUTO-TUNING** procedure by selecting a lower bandwidth (**Medium** or **Low**). If the problem remains, renew the **AUTO-TUNING** procedure by activating the anti-resonance filter (**Filter = Antiresonance**).

The antiresonance filter is accessible from the **BPCW** version **2.6** and higher and the amplifier EPROM version **5.7** and higher.

3.3 - LOUD NOISE IN THE MOTOR WHEN RUNNING

Select the highest position resolution on the slave motor (**Encoder resolution**) according to the maximum rotation speed (see table in Chapter 5, section 2). Modify also the master encoder resolution in order to keep the same reduction ratio.

3.4 - MOTOR POSITION OSCILLATION AT STANDSTILL

Check the rigidity of the transmission chain between motor and load (backlashes and elasticities in gearboxes and couplings). If required, increase the value of the **Motor dead band** value in the menu **Registration control** accessible in **Advanced functions**.

3.5 - WRONG PRODUCT REGISTRATION

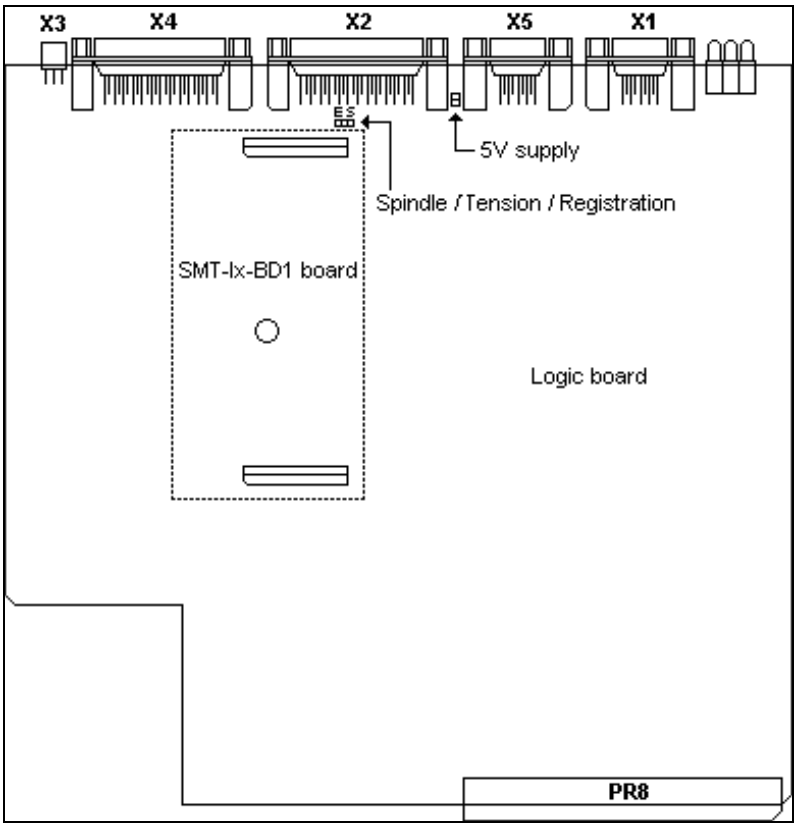
Check the photocell commutation polarity (rising edge on **RM** input at the product detection) as described in chapter 6, section 4.4. If the photocell signal polarity is not correct (rising edge on **RM** input after the product has gone by), reverse the photocell commutation adjustment (bright / dark).

Check for a correct accumulator loading in the case of a registration application with conveyor (very close products).

Check for the registration error indication (**REG** logic output). If the registration is not correct, proceed as described in section 2 of this chapter.

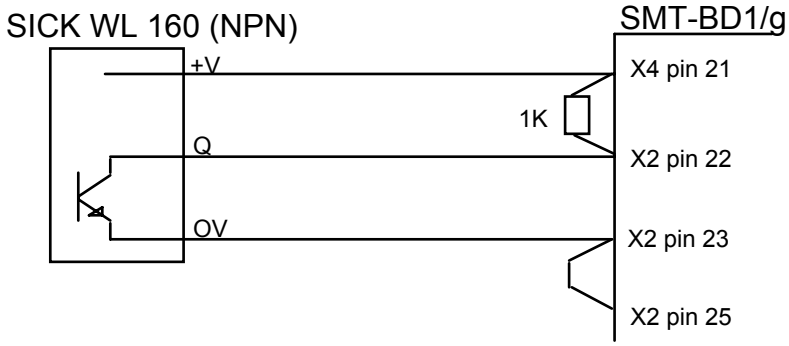
Chapter 8 - Appendix

HARDWARE LOCATION DIAGRAM

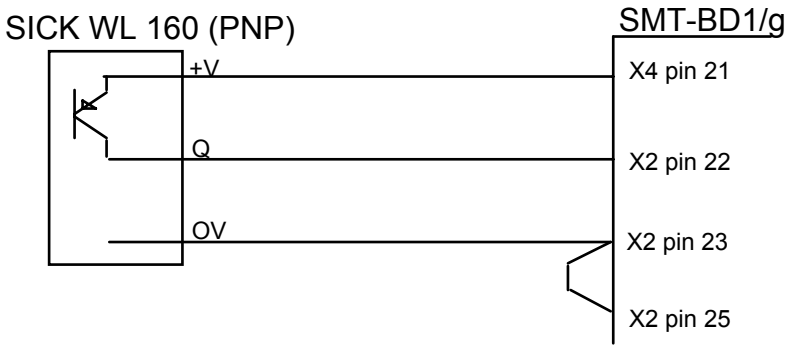


PHOTOCELLS WIRING

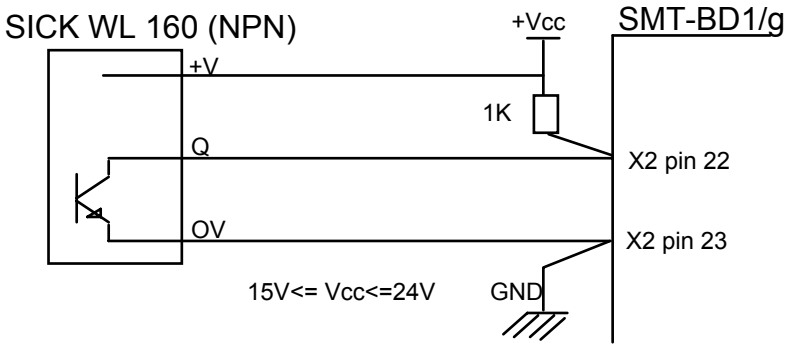
Connection of an NPN photocell with use of the + 15 V amplifier supply.



Connection of an PNP photocell with use of the + 15 V amplifier supply.



Connection of an NPN photocell with use of a supply external to the amplifier.



Connection of an PNP photocell with use of a supply external to the amplifier.