Spazio Forma

SERVICE & MAINTENANCE MANUAL

REV. 1.0

TECHNOGYM
The Wellness Company

The information contained in this manual is intended for QUALIFIED TECHNICIANS who have completed a specific TECHNOGYM training course and are authorized to perform machine start-up and adjustment procedures as well as extraordinary maintenance or repairs which require a thorough knowledge of the machine, its operation, its safety devices and working procedures.

CAREFULLY READ THE INFORMATION CONTAINED IN THIS MANUAL BEFORE PERFORMING ANY MAINTENANCE PROCEDURES ON THE MACHINE

DANGEROUS VOLTAGES PRESENT EVEN WHEN THE MACHINE IS TURNED OFF

NOTE
The information contained in this document is subject to change without notice.

Technogym does not guarantee this documentation in any way. Technogym shall not be held responsible for any errors contained in this manual and declines all liability for accidents or damages resulting from the supply, characteristics or use of this manual.

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1. GENERAL NOTICES

1.1. INTRODUCTION

This document is reserved for Technogym Service technicians, and is intended to provide authorized personnel with the necessary information to correctly carry out repairs and maintenance. A thorough knowledge of the technical information contained in this manual is essential for completing the professional training of the operator.

In order to facilitate consultation, the paragraphs are accompanied by schematic drawings which illustrate the procedure being described.

This manual contains notices and symbols which have a specific meanings:

 **WARNING: non observance may result in accident or injury.**

 **ATTENTION: non observance may cause damage to the machine.**

 **Information about the operation in progress.**

 **OBSERVE: observation about the operation in progress.**

1.2. RECOMMENDATIONS

Technogym recommends the following steps for planning repair procedures:

- Carefully evaluate the customer's description of the machine malfunction and ask all the necessary questions to clarify the symptoms of the problem.

- Clearly diagnose the causes of the problem. This manual provides the fundamental theoretical basis, which must then be integrated by personal experience and attendance at the training courses periodically offered by Technogym.

- Rationally plan the repair procedure so as to minimize the downtime necessary for procuring spare parts, preparing tools, etc.

- Access the component to be repaired, avoiding any unnecessary operations. In this regard it will be useful to refer to the disassembly sequence described in this manual.

1.3. GENERAL RULES FOR REPAIR PROCEDURES

1. Always mark any parts or positions which may be confused with each other at the time of reassembly.

2. Use original Technogym spare parts and lubricants of the recommended brands.

3. Use special tools where specified.

4. Consult the technical circulars, which may contain more up-to-date information on adjustments and maintenance than those contained in this manual.

5. Before starting the repair procedure, make sure that the recommended tools are available and in good condition.

6. For the procedures described in this manual, use only the specified tools.

OBSERVE: The tool sizes quoted in this manual are expressed in mm.

2. TECHNICAL CHARACTERISTICS

2.1. MECHANICAL CHARACTERISTICS

Width	816 cm
Length	203 cm
Height during exercise	134
Height machine closed	1164 cm
Weight	162 Kg

2.2. ELECTRICAL CHARACTERISTICS

Mains voltage	220 V
Frequency	50 Hz
Consumption	1650 VA - 7.5 A
Fuses	5x20 2xT10AH

2.3. AMBIENT SPECIFICATIONS

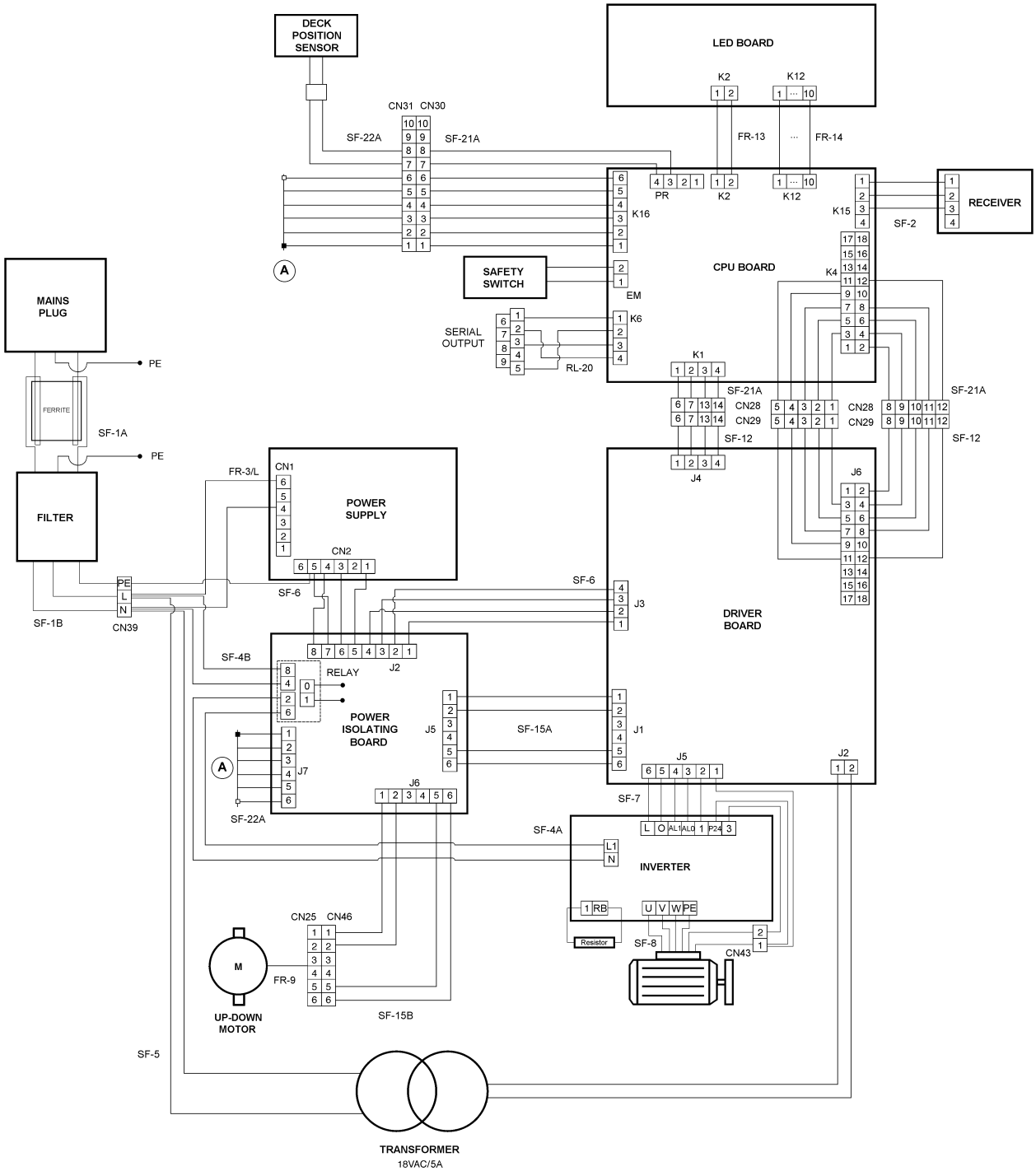
Temperature	Operating	from 10° to 25° C
	Storage	from 10° to 25° C
Humidity	Operating	from 20% to 90% non-condensing
	Storage	from 5% to 90% non-condensing

2.4. CONFORMITY TO REGULATIONS

The machine conforms to the following directives:

	Europe	USA
EMI	EN 60601-1-2	N.A.
Safety	EN 60601-1:90 +A1:93 +A12:93 +A2:95 +A13:96	
Exercise equipment	EN 957-6	
Directive	73/23/EEC 93/68/EEC 89/336/EEC	

2.5. WIRING DIAGRAM



2.5.1. CONNECTORS

- CPU board

name	type of connector	connection
K1	AMP MODU I 4x1 pin f.	to driver board (low voltage input)
K2	AMP MODU I 2x1 pin f.	to LED board (low voltage output)
K4	AMP MODU II 9x2 pin f.	to driver board (actuator drives)
K6	AMP MODU II 4x1 pin f.	to serial connector for TGS
K12	Flat 5x2 pin f.	to LED board (LED driver output)
K15	AMP MODU II 4x1 pin f.	to cardio receiver
K16	AMP MODU II 6x1 pin f.	to power isolating board (emergency signals)
EM	AMP MODU II 2x1 pin f.	to emergency button
PR	AMP MODU II 4x1 pin f.	to deck position sensor (sensor input)

- LED board

name	type of connector	connection
K2	AMP MODU I 2x1 pin f.	to CPU board (low voltage input)
K12	Flat 5x2 pin f.	to CPU board (LED driver input)

- Driver board

name	type of connector	connection
J1	AMP MATE-N-LOCK 3x2 pin f.	to up-down motor
J2	2 pin terminal block	to transformer (low voltage ac input)
J3	AMP MODU I 4x1 pin f.	to power supply (low voltage input)
J4	AMP MODU I 4x1 pin f.	to CPU (low voltage output)
J5	AMP MODU II 6x1 pin f.	to inverter (inverter drive)
J6	AMP MODU II 9x2 pin f.	to CPU board (actuator drive)

- Power supply

name	type of connector	connection
CN1	PANDUIT 6 pin m.	to filter (mains voltage input)
CN2	PANDUIT 6 pin m.	to driver board (low voltage output)

- Power isolating board

name	type of connector	connection
J2	AMP MODU I 8x1 pin f.	to power supply / driver board (low voltage)
J5	AMP MATE-N-LOCK 3x2 pin f.	to driver board (actuator up-down motor)
J6	AMP MATE-N-LOCK 3x2 pin f.	to up-down motor (actuator up-down motor)
J7	AMP MODU II 6x1 pin f.	to CPU board (emergency signals)
Relay	Fast on	to filter / inverter (inverter power supply)

- Portable connectors

name	type of connector	connection
CN28	MOLEX mini-fit 7x2 m. portable	to CPU board (actuator drive)
CN29	MOLEX mini-fit 7x2 f. portable	to driver board (actuator drive)
CN30	MOLEX mini-fit 5x2 m. portable	to CPU board (emergency signals / deck sensor)
CN31	MOLEX mini-fit 5x2 f. portable	to power isolating board / deck position sensor (emergency signals / deck sensor)
CN39	Terminal block	to filter, power supply, inverter and selector
CN46	MOLEX mini-fit 3x2 f. portable	to up-down motor

2.5.2. WIRING

SF-1A: Filter cable Power inlet socket – Filter				
Power inlet socket	**Signal**	**Color**	**Filter**	**PE**
Fast on	Live	Black	Fast on	-
Fast on	Neutral	Blue	Fast on	-
Fast on	Earth	Yellow-green	-	Eyelet
-		Yellow-green	Fast on	

This cable incorporates a 348 Ohm, 100 Mhz ferrite with coil on the live and neutral conductors.

SF-1B: High voltage power supply cable Filter – High voltage distribution terminal block			
Filter	**Signal**	**Color**	**Terminal block CN39**
Fast on	Live	Black	L
Fast on	Neutral	Blue	N
Fast on	Earth	Yellow-green	PE

SF-2: Heart rate meter cable CPU board – Heart rate receiver			
CPU board K15	**Signal**	**Color**	**Receiver**
1	+5 Vdc	Red	1
2	Pulse per beat	Blue	2
3	Gnd	Black	3

FR-3/L: Power supply high voltage input cable High voltage distribution terminal block – Power supply			
Terminal block CN39	**Signal**	**Color**	**Power supply CN1**
N	Neutral	Blue	4
L	Live	Black	6

SF-4A: Inverter high voltage input cable Power isolating board - Inverter			
Power isolating board Relay	**Signal**	**Color**	**Inverter**
2	Neutral	Blue	N
6	Live	Red	L1

SF-4B: Inverter high voltage input cable High voltage distribution terminal block – Power isolating board			
Terminal block CN39	**Signal**	**Color**	**Power isolating board Relay**
N	Neutral	Blue	4
L	Live	Red	8

SF-5: Transformer high voltage input cable High voltage distribution terminal block – Transformer			
Terminal block CN39	**Signal**	**Color**	**Transformer**
N	Neutral	Blue	already connected
L	Live	Black	already connected

SF-6: Low voltage power supply cable Power isolating board - Driver board			
Power isolating board J2	**Signal**	**Color**	**Driver board J3**
1	+ 12 Vdc	Blue	1
2	+ 5 Vdc	Yellow	4
3	ground	White	3
4	ground	Purple	2

SF-6: Low voltage power supply cable Power supply – Power isolating board				
Power isolating board J2	**Signal**	**Color**	**Power supply CN2**	**Terminal block CN39**
5	+ 12 Vdc	Red	1	-
6	+ 5 Vdc	Orange	3	-
7	ground	Black	5	-
-		Yellow-green		PE
8	ground	Brown	4	-

SF-7: Inverter cable Driver board – Inverter				
Driver board J5	**Signal**	**Color**	**Inverter**	**CN43**
-	Thermal cutout	Green	3	2
1	Thermal cutout Gnd	White	-	1
-		White	P24	
2	Start	Grey	1	-
3	Alarm	Red	AL0	-
4	Alarm Gnd	Purple	AL1	-
5	Speed	Brown	O	-
6	Speed Gnd	Black	L	-

SF-8: Tread-belt motor cable Inverter – Tread-belt motor				
Inverter	**Signal**	**Color**	**Motor**	**CN43**
U	Phase U	Black 1	already connected	-
V	Phase V	Black 2	already connected	-
W	Phase W	Black 3	already connected	-
-	Thermal cutout	Black 4	already connected	1
-	Thermal cutout Gnd	Black 5	already connected	2
PE	Earth	Yellow-green	already connected	-

FR-9: Up-down motor cable Portable connector – Up-down motor cable			
Portable CN25	**Signal**	**Color**	**Up-down motor**
1	Motor +	White	already connected
2	Motor -	Blue	already connected
5	Up-down motor pulses	Red	already connected
6	Pulse Gnd	Black	already connected

FR-10: Braking resistor cable Inverter – Braking resistor			
Inverter	**Signal**	**Color**	**Resistor**
1	Positive	White	already connected
RB	Negative	White	already connected

SF-12: CPU cable – lower section Portable connector – Driver board				
Portable CN29	**Signal**	**Color**	**Driver board**	
			J4	**J6**
1	Up-down motor “down”	Green	-	3
2	Up-down motor “up”	Yellow	-	5
3	Up-down motor alarm	Blue	-	7
4	Up-down motor pulses	Purple	-	9
5	Pulse Gnd	Black-green	-	11
6	+12 Vdc	Red	1	-
7	Gnd	Black	2	-
8	+5 Vdc	Red	-	2
9	Tread-belt motor speed PWM	Grey	-	4
10	Start tread-belt motor	Brown	-	6
11	Tread-belt motor alarm	Orange-yellow	-	8
12	Gnd	Black	-	12
13	Gnd	Grey	3	-
14	+5 Vdc	Orange	4	-

FR-13: LED board supply cable CPU board – LED board			
CPU board K2	**Signal**	**Color**	**LED board K2**
1	+5 Vdc	Red	1
2	Gnd	Black	2

FR-14: LED board signal cable CPU board – LED board			
CPU board K12	**Signal**	**Color**	**LED board K12**
1	-		1
2	STROLED		2
3	MUX2		3
4	MUX1		4
5	MUX0		5
6	OELED		6
7	SCK		7
8	MOSI		8
9	DOE		9
10	-		10

This cable incorporates a 65 Ohm, 100 MHz coil-less ferrite.

SF-15A: Actuator up-down motor cable Driver board – Power isolating board			
Driver board J1	**Signal**	**Color**	**Power isolating board J5**
1	Motor +	White	1
2	Motor -	Blue	2
5	Up-down motor pulses	Red	5
6	Pulse Gnd	Black	6

SF-15B: Actuator up-down motor cable Power isolating board – Portable connector			
Power isolating board J6	**Signal**	**Color**	**Portable CN46**
1	Motor +	White	1
2	Motor -	Blue	2
5	Up-down motor pulses	Red	5
6	Pulse Gnd	Black	6

RL-17: Emergency cable CPU board – Emergency button			
CPU board EM	**Signal**	**Color**	**Emergency button**
1	Gnd	White	Already connected
2	Signal	Black	Already connected

RL-20: TGS cable CPU board – Serial connector			
CPU board K6	**Signal**	**Color**	**Serial connector**
1	+12 Vdc	Yellow	1
2	Gnd	Green	5
3	Tx	White	3
4	Rx	Brown	2

SF-21A: CPU cable / Emergency signals – upper section				
CPU board – Portable connector CN28				
CPU board		**Signal**	**Color**	**Portable**
K1	**K4**			**CN28**
1	-	+12 Vdc	Red	6
2	-	Gnd	Black	7
3	-	Gnd	Grey	13
4	-	+5 Vdc	Orange	14
-	2	+5 Vdc	Red	8
-	3	Up-down motor “down”	Green	1
-	4	tread-belt motor speed PWM	Grey	9
-	5	Up-down motor “up”	Yellow	2
-	6	Start tread-belt motor	Brown	10
-	7	Up-down motor alarm	Blue	3
-	8	Tread-belt motor alarm	Orange-yellow	11
-	9	Up-down motor pulses	Purple	4
-	11	Pulse Gnd	Black-green	5
-	12	Gnd	Black	12
CPU board – Portable connector CN30				
CPU board		**Signal**	**Color**	**Portable**
K16	**PR**			**CN30**
1	-	+5 Vdc	Red	1
2	-	Relay output	Blue	2
3	-	Safety switch input	Yellow	3
4	-	Trigger signal	Green	4
5	-	Gnd	Black	5
6	-	Gnd	Black	6
-	4	Gnd	Orange-yellow	7
-	3	Segnale sensore	Brown	8

This cable incorporates a 348 Ohm, 100 Mhz coil-less ferrite.

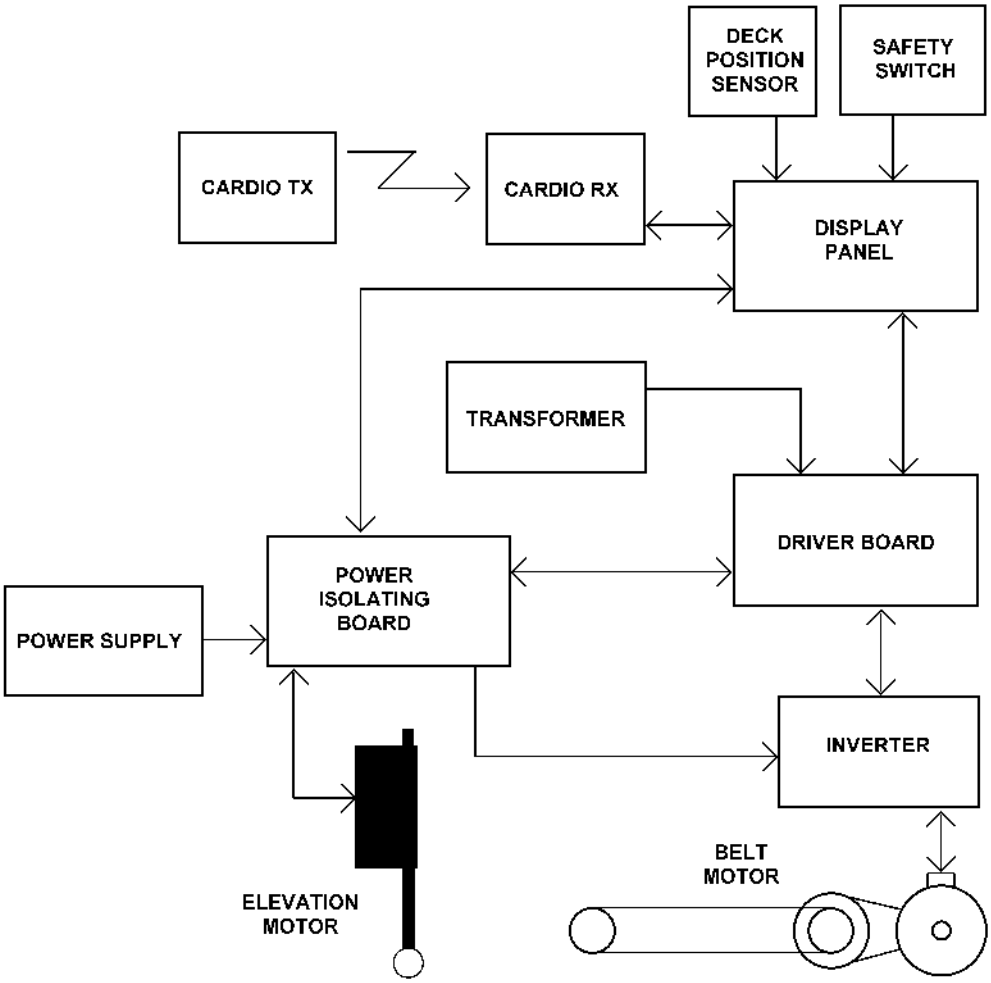
SF-22A: Emergency signals – lower section Portable connector CN31 – power isolating board - deck position sensor				
Portable CN31	**Signal**	**Color**	**Power isolating board J7**	**Deck position sensor**
1	+5 Vdc	Red	1	-
2	Relay output	Blue	2	-
3	Safety switch signal	Yellow	3	-
4	Trigger signal	Green	4	-
5	Relay output	Black	5	-
6	Gnd	Black	6	-
7	Gnd	Orange-yellow	-	already connected
8	Sensor signal	Brown	-	already connected

Note that this is a simplified description of the cables, which does not include the ground node connections of the electronics box.

3. PRINCIPLES OF OPERATION

3.1. BLOCK DIAGRAM

The block diagram of the machine is shown in the figure below:



3.1.1. CARDIO TRANSMITTER

It is worn by the person using the machine, and transmits to the cardio receiver one pulse for every heart beat that is detected.

Only the traditional version of the component (non coded) is used.

3.1.2. CARDIO RECEIVER

It is connected to the machine's CPU board and receives the pulses sent by the transmitter. Its reception area is approximately a circle of 1 meter of radius. If there is electromagnetic noise (produced by high voltage lines, radio transmitters, monitors, motors, etc.) within its reception area,

the receiver becomes saturated and stops receiving any signal. If there are 2 transmitters within its area of reception, it will receive signals from both, and may produce an error or irregular reading.

Only the traditional version of the component (non coded) is used.

3.1.3. DISPLAY

This is the heart of the machine, which controls all the machine functions by executing the program stored in EPROM. It receives information from the user (age, weight, etc.) during set-up of the training session, from the cardio receiver (user's heart rate), and from the driver board. It controls the speed selected with the "+" "–" keys and the elevation selected with the "↑" "↓" keys or according to the chosen training program. It receives the error signals for the tread-belt motor and the up-down motor from the driver board, as well as the up-down motor pulses.

It consists of 2 circuit boards:

- **CPU board**: contains the microprocessor, the EPROM and all the control logic of the machine. This circuit board incorporates a set of 4 dip-switches which is not currently used.
- **LED board**: contains the circuits for the LED indicators and the 7 segment display.

3.1.4. DRIVER BOARD

Consists of 3 distinct sections integrated into a single circuit board:

- **Driver**: receives from the display a digital inverter-enable signal and a PWM signal proportional to the programmed speed, which it converts into a dc voltage for driving the inverter. In the event of an anomaly, receives the error signal from the inverter and transmits it to the CPU board.

  The circuit board includes a trimmer, component R36, labeled "Reg. velocità" on the printed circuit board, which regulates the conversion of the PWM into an analog signal in order to adjust the motor speed.

- **Up-down motor control**: receives the incline "up" or "down" signals from the display, and converts them into a voltage for driving the up-down motor. Generates its own supply voltage and the dc supply voltage for the motor by means of the transformer and rectifier bridge. Receives the pulses output by the sensor incorporated into the motor, filters them and sends them to the CPU board. In the event of a motor overcurrent condition, shuts down the motor drive and sends an alarm signal to the display.

  The circuit board includes a trimmer, component R68, labeled "Reg. I Max" on the printed circuit board, which adjusts the motor current limit.

- **DC voltages by-pass**: receives the low voltages generated by the power supply and sends them to the CPU board.

3.1.5. INVERTER

This is the device which supplies the three-phase belt motor. It receives a DC reference voltage from the driver board. Variations in this voltage cause corresponding variations in the operating frequency of the sinusoidal wave provided by the inverter to the motor phases, and hence change the speed of the tread-belt. It handles motor drive errors and, in the event of an error, shuts down the power supply to the motor and sends an alarm signal through the driver board to the display. The event which caused the error is memorized as an error code.

The model used is **Hitachi SJ100** version SJ100-015NFE with a power rating of 1.5 KW (2 Hp).

WARNING: The inverter is isolated from earth. It is fixed using plastic screws and washers to ensure its isolation from the machine frame.

3.1.6. BELT MOTOR

An asynchronous three-phase motor which, by means of a pulley and a poly-v belt, turns the driving roller of the tread-belt. Each motor phase is equipped with a normally-closed bimetallic safety which opens when the temperature exceeds a preset threshold, in order to safeguard the integrity of the motor. The 3 bimetallic safeties are connected in series and reach the inverter as a NC external input signal. When this contact opens, the inverter generates an alarm.

The tread-belt motor has a power of 1.5 KW (2 Hp).

WARNING: The tread-belt motor is isolated from earth. It is fixed using plastic bushings and dowels to ensure its isolation from the machine frame.

3.1.7. UP-DOWN MOTOR

This is a linear actuator equipped with a 24 V DC motor, incorporating a reduction unit and a rod that is moved backward and forward by the motor. The rod actuates a frame connected to the front wheels of the machine: when the rod moves it causes the frame to move, thereby raising or lowering the machine.
The actuator has a built-in reed sensor which functions as an encoder, outputting pulses as the motor turns. This provides the necessary feedback signal for determining the position of the rod and hence the machine incline.

3.1.8. POWER SUPPLY

Receives the mains voltage at its input and outputs the DC voltages (+5 V and +12 V) which supply the display and the inverter interface board. This power supply is equipped with mains voltage autosensing.

3.1.9. TRANSFORMER

Is equipped with two 110 VAC primaries and one 18VAC/5A secondary. This transformer powers the driver boards for the up-down section.

3.1.10. SAFETY SWITCH

This is the user safety device. It is implemented by a reed relay which is NC when the “Safety switch”, a plastic button containing a magnet, is correctly positioned on the display panel. Its signal

is input to the CPU board. If the user is in difficulty and detaches the “Safety switch” from the display by pulling the attached cord, the contact opens and the CPU board detects the transition and the "EMERGENCY ACTIVATED" message appears on the display. In addition, the signal also passes through the power isolating board which cuts off the power supply to the up-down motor and the inverter.

The machine is equipped with a larger flywheel than the previous models, to allow for less abrupt stopping of the tread belt in response to a machine malfunction or the emergency button being pressed.

3.1.11. DECK POSITION SENSOR

This device prevents any movements of the tread belt or machine incline if the running deck is not opened out in the working position.
It consists of a magnetic sensor on the fixed part of the machine frame and a magnet on the moving part of the frame comprising the running deck. When the machine is open with the deck in the working position, the magnet is aligned with the sensor and closes a contact. Otherwise, the sensor does not detect the presence of the magnet and the contact is open. The CPU which receives these signals communicates with the power isolating board, which inhibits all machine movements in the case of an open contact.

3.1.12. POWER ISOLATING BOARD

This board cuts off the power supply to the components that actuate the machine movements: up-down motor and inverter. When an emergency condition occurs, the power isolating board interrupts the power supply to the up-down motor and to the inverter which drives the tread belt motor, thereby ensuring that all movements are inhibited by physically isolating the power supply.
This board enhances the safety of the machine, because activating an emergency not only causes the condition to be signaled via SW to the CPU, but also interrupts the power supply to the two isolating relay coils on this board, thereby shutting off the power supply to the moving parts.
The power supply to the relay coils is controlled not only by the emergency button contact, but also by a monostable timer which receives a trigger signal from the CPU to indicate its correct functioning. If this signal changes frequency or fails to arrive for a certain period, the timer output changes state, de-energizing the relays.
The power isolating board also provides a feedback signal to the CPU, informing it about the emergency status. This is simply an indication of the emergency-activated state, confirming to the CPU that the board has correctly responded to the emergency request.
The power isolating board also includes three LEDs:

- **Yellow LED:** indicates the status of the 5 Vdc supply, and is illuminated if the voltage is present.
- **Green LED:** indicates the status of the 12 Vdc supply, and is illuminated if the voltage is present.
- **Red LED:** indicates the emergency status of the machine, and is illuminated if the machine is not in an emergency condition.

3.2. TREAD-BELT MOTOR DRIVE

3.2.1. MECHANICS

The tread-belt is actuated by the motor through a linkage consisting of the motor pulley, the driving roller and the belt which connects them. In this way, a given belt motor speed corresponds to a predetermined linear tread-belt speed. The belt motor is controlled by the inverter which generates a variable-frequency sine wave signal: variations in frequency cause the motor speed and hence the tread-belt speed to vary.

3.2.2. CONTROLS

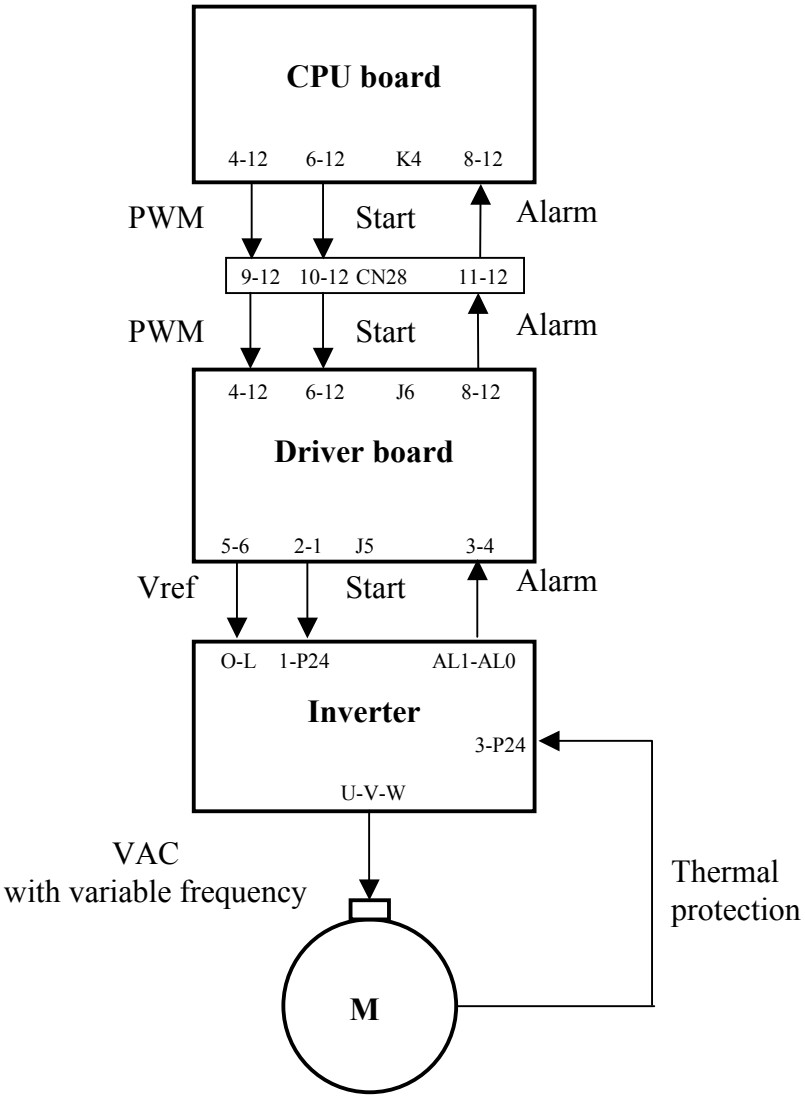
To start the motor, the CPU board sends a Start signal to the inverter through the driver board, enabling the inverter to drive the motor. After outputting this enable signal, the CPU board sets the motor speed by sending a PWM signal to the driver board, which the driver board converts into an analog input voltage to the inverter. The relationship between the analog input voltage and the inverter output frequency is determined by the values of the configuration parameters in the inverter program.

During its movement, the inverter checks the motor and, if any problems are detected (overvoltage, overcurrent, SW and HW problems to the inverter, etc.) it halts the motor and sends an alarm signal to the CPU board, which displays the error message “E3”.

To protect the motor from overheating, each motor phase has a thermal cutout connected in series. If the temperature exceeds the threshold value, the thermal cutout opens and interrupts the circuit. The inverter detects this condition as the opening of a NC external contact. In such a case the inverter halts the motor and outputs an alarm signal to the CPU board, which displays the error message cited above.

3.2.3. THE SIGNALS INVOLVED

The machine controls the speed of the belt motor by means of the CPU board and the inverter interface board, as shown in the following figure:



The speed control utilizes the following signals:

- **Start signal**
  This is the signal generated by the CPU board to enable starting of the motor (pin 6-12 on connector K4). When the tread-belt is stopped this signal is at logic level low (0.2 Vdc), whereas immediately after the "Start" key on the display is pressed it goes high (4.8 Vdc).
  This signal enters the driver board (pin 6-12 on connector J6), is processed and sent out (pin 2-1 on connector J5 of the driver board) to the inverter (pin 1-P24). In the belt-stopped conditions it is -23.8 Vdc, while immediately after pressing the "Start" key on the display it is 0 Vdc.

- **Speed reference signal**
  This is the signal generated by the CPU board (pin 4-12 on connector K4) to control the motor speed. It is a PWM signal, i.e. a fixed-frequency square wave signal with variable duty cycle. The logic of this control has the duty cycle decreasing with increasing speed, from a maximum of approximately 5 Vdc down to a few hundred mVdc.
  The signal enters the driver board (pin 4-12 on connector J5), is converted into a variable analog signal between 0 and 10 Vdc, and sent out (pin 5-6 on connector J5 of the driver board) to the inverter (pin O-L). The signal input to the inverter increases with increasing speed.
  On the driver board there is a trimmer which adjusts the speed by regulating the analog/digital conversion of the PWM and Vref signals, as described in paragraph 8.6. "Calibrating the tread-belt speed".

  The relationship between the speed reference voltage and the inverter output frequency is determined by the values of the configuration parameters in the inverter program.

- **Variable frequency VAC signal**
  This is the variable frequency alternating voltage generated by the inverter (pin U-V-W) for supplying the motor. The motor speed increases with increasing frequency.

- **Thermal cutout signal**
  Each motor phase is equipped with a normally-closed thermal cutout which opens when the temperature exceeds a preset threshold. The 3 thermal cutouts are connected in series and exit the motor via a 2-wire cable connected to the inverter (3-P24). The inverter is programmed to expect a NC signal on these pins. When at least one thermal cutout is tripped, the contact opens and the inverter, detecting the open-circuit condition, generates an alarm signal.

- **Alarm signal**
  This is the signal generated by the inverter (AL1-AL0) if a problem is detected in the motor drive, or if the motor thermal cutouts open. It enters the driver board (pin 3-4 on connector J5) and its value is 0 Vdc under normal conditions, 5 Vdc under alarm conditions.
  The signal is then sent from the driver board (pin 8-12 on connector J6) to the CPU board (pin 8-12 on connector K4); its value is 0.2 Vdc under normal conditions, 5 Vdc under alarm conditions. When this alarm signal switches to 0 Vdc, the CPU disables the Start signal, resets the PWM signal and shows error message "E3" on the display.

The power supply to the inverter is controlled from the power isolating board by means of a relay which interrupts the supply if an emergency has been activated as described in paragraph 3.1.12. "Power isolating board".

The machine is equipped with a larger flywheel than the previous models, to allow for less abrupt stopping of the tread belt in response to a machine malfunction or the emergency button being pressed.

3.3. UP-DOWN MOTOR DRIVE

3.3.1. MECHANICS

The machine incline is varied by the up-down motor rod, which moves a frame connected to the front wheels. The motor movement is detected by a hall sensor which provides the motor motion control signal: each motor revolution corresponds to a predetermined number of pulses and to a predetermined displacement of the rod, and hence of the machine incline. The direction of rotation of the motor determines whether the machine moves up or down.

3.3.2. THE RESET PROCEDURE

On power-up, the machine performs a reset procedure in order to determine the reference incline. The procedure consists of the following steps:

- The machine performs a brief upward movement and then descends until the up-down motor rod reaches the fully inserted position and stops. This is the reference "zero position" for the incline: all the movements for reaching different elevations will be variations referred to this reference.
- Upward movement of the machine until the machine reaches the established 0.0% incline position.

3.3.3. CONTROLS

To vary the incline, the CPU board sends the driver board an Up signal (move the motor in the up direction to increase the elevation) or a Down signal (move the motor down to decrease the elevation). The driver board accordingly actuates the motor in the appropriate direction, by supplying it with a positive or negative voltage. When the motor moves, the sensor generates the pulses which are received by the driver board. The driver board filters the pulses and sends them to the CPU board which counts the pulses received, and on reaching the number corresponding to the desired incline, resets the Up or Down signal which produced the movement.

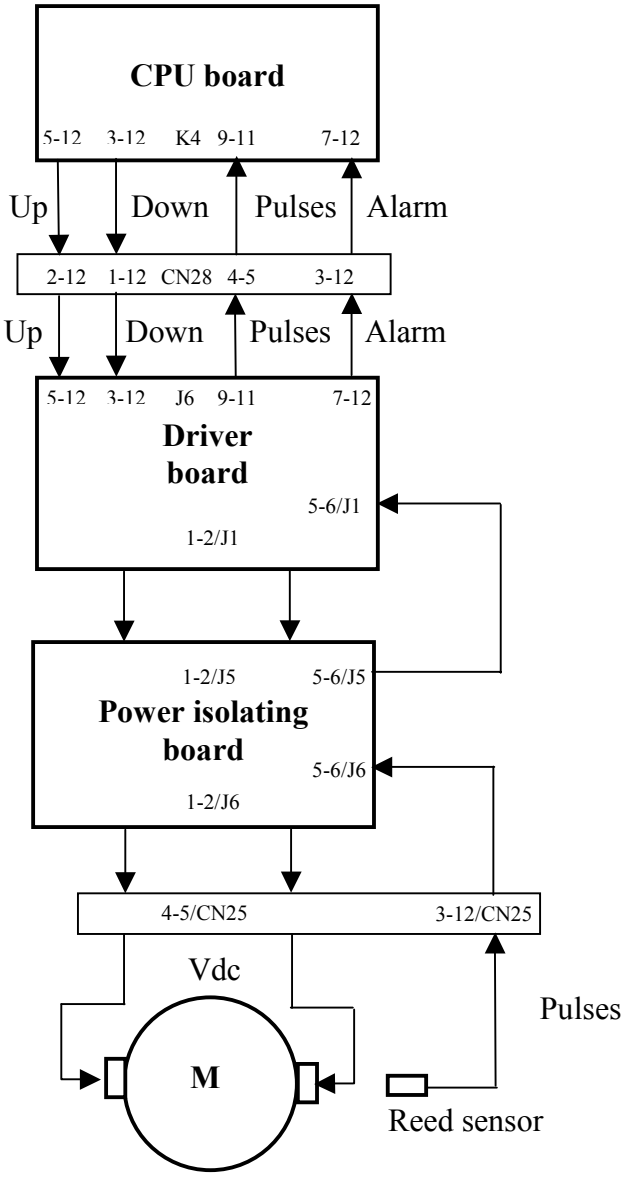
If, after having asserted the Up or Down signal, the driver board detects a motor overcurrent, it shuts down the supply to the motor and sends an alarm signal to the CPU board. On receiving the alarm signal, the CPU board resets the Up or Down signal which generated the problem, and displays error message "E5".

On power-up, the machine performs a reset procedure in order to determine the reference incline. The procedure consists of the following steps:

- Small upward movement of the machine;
- Downward movement of the machine until the motor rod is fully inserted and blocked. This causes the motor to be supplied with the rotor blocked. In these conditions, the motor draws such a high current that the driver board shuts down its supply and sends an alarm signal to the CPU. The receipt of this alarm signal defines the reference "zero position" for the incline: all the movements for reaching different elevations will be variations referred to this reference.
- Upward movement of the machine until the CPU board receives a predetermined number of pulses, corresponding to the movement of the rod to the established 0.0% incline position.

3.3.4. THE SIGNALS INVOLVED

The machine controls the incline through the CPU board and the driver board, as illustrated in the figure below:



The control logic involves the following signals:

- **Up Signal**
  This is the signal generated by the CPU board (pin 5-12 on connector K4) to enable movement of the up-down motor in the "up" direction. In normal conditions the signal is at logic level low (0 Vdc), and it goes high (4.65 Vdc) to actuate the motor. The signal remains high for the entire duration of the movement.
  The signal enters the driver board (pin 5-12 of connector J6) and enables the movement of the motor in the desired direction.

- **Down signal**
  This is the signal generated by the CPU board (pin 3-12 on connector K4) to enable movement of the up-down motor in the "down" direction. In normal conditions the signal is at logic level low (0 Vdc), and it goes high (4.65 Vdc) to actuate the motor. This signal remains high for the entire duration of the movement.
  The signal enters the driver board (pin 3-12 on connector J6) and enables movement of the motor in the desired direction.

- **Motor voltage signal (Vdc)**
  This is the DC voltage generated by the driver board (pin 1-2 of connector J1) to supply the up-down motor. Its absolute value is 24 Vdc, and the motor will rotate either clockwise or anticlockwise depending on its polarity, causing the rod to become longer or shorter, thereby increasing or decreasing the machine incline.
  This signal is filtered by the power isolating board, which interrupts it in the event of an emergency condition as described in paragraph 3.1.12. "Power isolating board".

- **Pulse signal**
  This is a square wave signal alternating between logic level low (8.8 Vdc) and logic level high (11.4 Vdc), generated by the hall sensor incorporated into the motor. This signal reaches the driver board (pin 5-6 on connector J1).
  The signal is level-converted, filtered, squared and output (pin 9-11 on connector J6) to the CPU board (pin 9-11 on connector K4) for controlling the movement. The output signal is still a square wave signal, but alternating between 0 and 5 Vdc.
  This signal is filtered by the power isolating board, which interrupts it in the event of an emergency condition as described in paragraph 3.1.12. "Power isolating board".".

- **Alarm signal**
  This is the signal generated by the driver board (pin 7-12 on connector J6) when it detects a motor overcurrent condition. This signal is sent to the CPU board (pin 7-12 on connector K4). As soon as the CPU board receives this signal, it resets the up or down command which caused the alarm condition, to protect the motor from damage due to overcurrent.

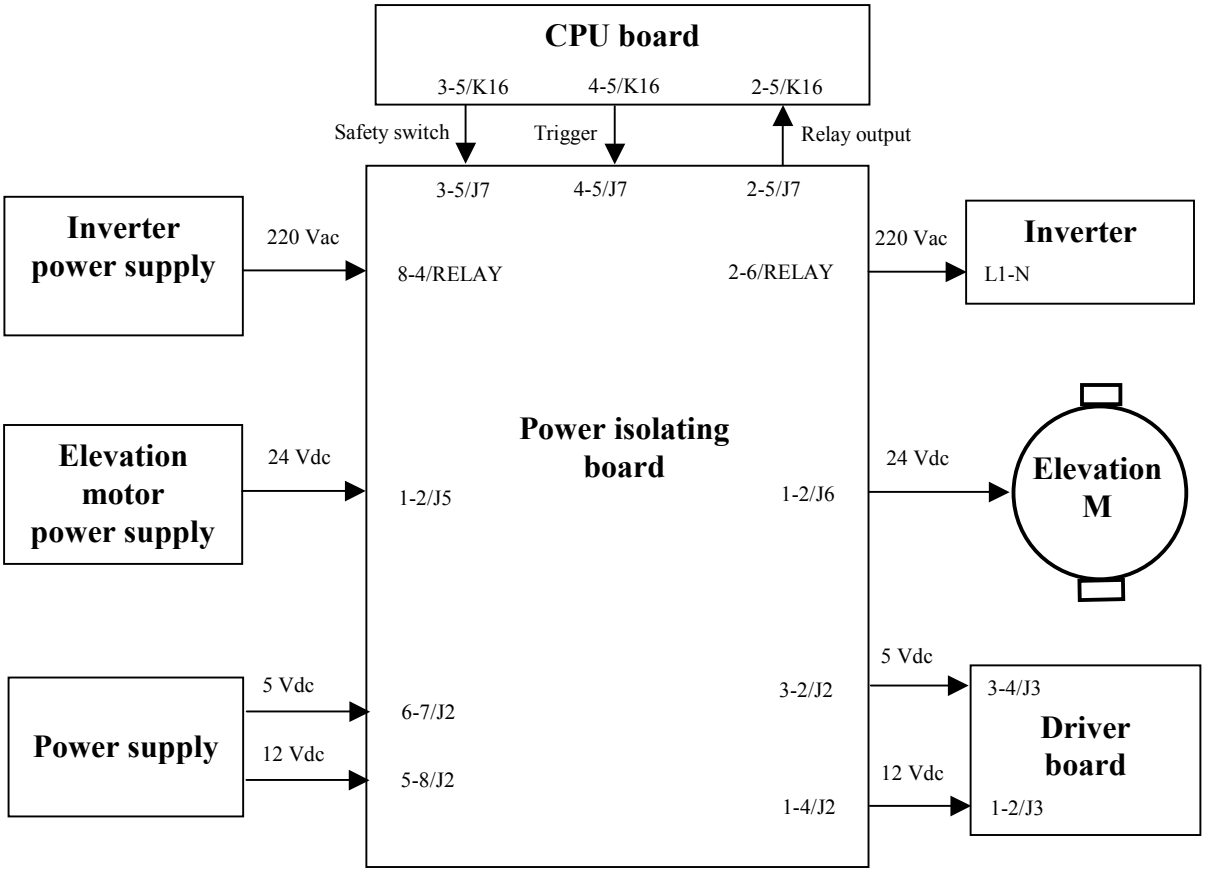
  The control logic enables the weight stack motor interface board to freely drive the motor when the alarm signal is at logic level high (5 Vdc). As soon as this signal goes low (0 Vdc) the CPU board resets the previously asserted up or down motor signal, causing the weight stack motor interface board to reset the alarm signal, which thus returns high. All this takes place within a few msec.

3.4. SAFETY OF MOVING PARTS

3.4.1. CONTROLS

The power isolating board directly controls the power supply to the inverter, which in turn controls the tread belt motor and the up-down motor.
This board receives an input signal from the emergency button and a trigger signal generated by the CPU to denote its correct operation. If one of the two signals fails to arrive or is corrupted, the board immediately shuts off the power supply to the two components which actuate the machine movements, and sends an output signal to the CPU confirming the correct response to the emergency request.
The power isolating board also filters the 5-12 Vdc voltages received from the power supply and directed to the driver boards.

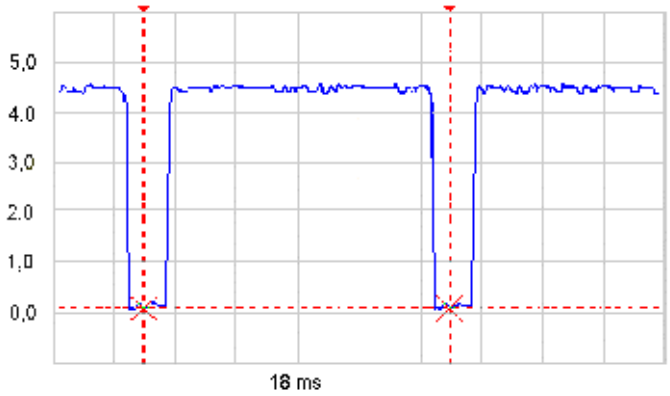
3.4.2. THE SIGNALS INVOLVED



The control logic involves the following signals:

- **Emergency signal**
  This is the signal received from the emergency button, which the CPU board outputs (pins 3-5 of connector K16) to the power isolating board (pin 3-5 of connector J7). Under normal operating conditions, the level of this signal is 0 Vdc, and it switches to 5 Vdc when the emergency is activated.

- **Trigger signal**
  This is the signal generated by the CPU board and output (pins 4-5 of connector K16) to the power isolating board (pins 4-5 of connector J7) to activate the monostable timer. Under normal operating conditions the signal will appear in the figure below, if viewed with an oscilloscope:



  The signal level is 4.4 Vdc with pulses at 0 Vdc at a frequency of 63 Hz. If the emergency is activated the signal remains constantly at 4.4 Vdc.

- **Relay status signal:**
  This is the signal which the power isolating board (pins 2-5 of connector J7) sends to the CPU (pins 2-5 of connector K16), with information about the status of the relay. Under normal operating conditions the level of this signal is 0 Vdc, and it switches to 5 Vdc when the emergency is activated.

- **Inverter power supply voltage**
  This is the 220 Vac line voltage which supplies the inverter. It comes in from the power inlet block to pins 8-4 of the relay. The signal output on pins 2-6 of the relay is 0 Vac if the machine emergency has been activated.

- **Up-down motor supply voltage**
  This is the DC voltage generated by the driver board to supply the up-down motor. It is input on pins 1-2 of connector J5. Its absolute value is 24 Vdc and, depending on its polarity, the motor will move either in a clockwise or anticlockwise direction. The signal output on pins 1-2 of connector J6 is 0 Vac if the machine emergency has been activated.

- **Voltage signals for the driver board**
  These are the voltages generated by the power supply for the driver board, which are input on connector J2. Pins 5-8 receive a 12 Vdc signal, while pins 6-7 receive a 5 Vdc signal.
  The same connector outputs the signals which go to connector J2 on the driver board: 12 Vdc on pins 1-4, and 5 Vdc on pins 3-2.

4. ACCESSORIES

4.1. CONNECTING TO THE TGS

The machine can be connected to the Technogym System by installing a special upgrade kit. The CPU board is connected to the serial connector via the cable described below, which is supplied together with the upgrade kit.

To connect a TGS-ready machine, use the RS 232 serial port on the CPU board, made available through a 9-pin D-connector situated at the rear of the control panel.

The TGS reader is of type 232.

For further details, including troubleshooting information, refer to the manual: “Technogym System: Installation guide”.

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5. INSTALLATION INSTRUCTIONS

5.1. SPECIFICATIONS AND REQUIREMENTS

For correct machine installation, make sure that:

1. The machine is installed on a level surface that is free of vibrations and has sufficient carrying capacity for the combined weight of the machine and user.
2. The environment is dust or sand free.
3. The environment meets the operating temperature and humidity conditions specified in paragraph 2.3. .
4. The machine is not positioned close to sources of heat, sources of electromagnetic noise (television sets, electric motors, antennas, high voltage lines, appliances etc…) or medical equipment.
5. To eliminate any interference with the cardio receiver, there should not be any transmitters at a distance of 100 cm from the display.
6. The mains voltage must match the value specified on the machine rating plate.
7. The electrical system must be provided with an efficient ground connection.
8. The wall outlet used should be reserved for the machine and have a rating of at least 2000 Watt.
9. Do not connect other machines or users to the same wall outlet.
10. Position the mains lead of the machine where is will not be underfoot. For this purpose, it is recommended to use the special trackways supplied with the machine.

5.2. INSTALLATION

To correctly install the machine, proceed as follows:

1. Ensure that the specifications and requirements for installation have been met (see paragraph 5.1.).
2. Position the machine as specified above, on a level surface that is free of vibrations and has sufficient carrying capacity for the combined weight of the machine and the user.
3. The machine is shipped partially disassembled, and packed in a carton fixed to a wooden pallet. For assembling follow the procedure described in the “User and maintenance manual” supplied with each machine.
4. Connect the mains lead to the inlet socket on the machine.
5. Place the on/off switch in the “0” position.
6. Plug the mains lead into the electrical outlet.

5.3. FIRST POWER-ON

After completing the installation procedure, the machine is ready to be powered up. To turn on the machine, simply toggle the on/off switch from the 0 position to the 1 position.

When the machine is turned on it will perform a power-on test which:

- sounds the buzzer;
- lights all the LEDs;
- resets the elevation.

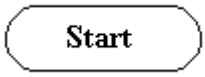
After completing this power-on test the machine enters standby mode, awaiting a keyboard command.

To check the correct operation of the machine:

- open the machine, placing the running deck on the ground;
- get on the machine;
- press the “Start” key on the keyboard to begin exercising;
- check that the belt motor starts;
- press the “+” and “–” keys on the keyboard and check that the tread-belt speed changes accordingly;
- press the “↑” and “↓” keys on the keyboard and check that the machine elevation changes accordingly;
- operate the “Safety switch” and check that the tread-belt stops;
- put on the heart rate transmitter and check that the machine correctly measures the heart rate value.

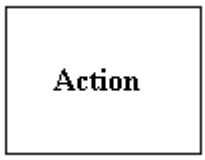
6. TROUBLESHOOTING

The troubleshooting procedures are shown in the form of flow charts. In order to facilitate consultation, the following standard box shapes are used.



This type of box is the START point of the troubleshooting procedure. It typically contains a description of the problem or malfunction.

This type of box represents a decision point in the troubleshooting procedure. It typically contains a description of the DECISION to be made, with an outcome that can be either a positive (YES) or negative (NO) response.



This type of box corresponds to a step in the troubleshooting procedure where an ACTION must be carried out. It typically contains a description of the ACTION necessary to resolve the problem. Therefore, after executing the specified ACTION:

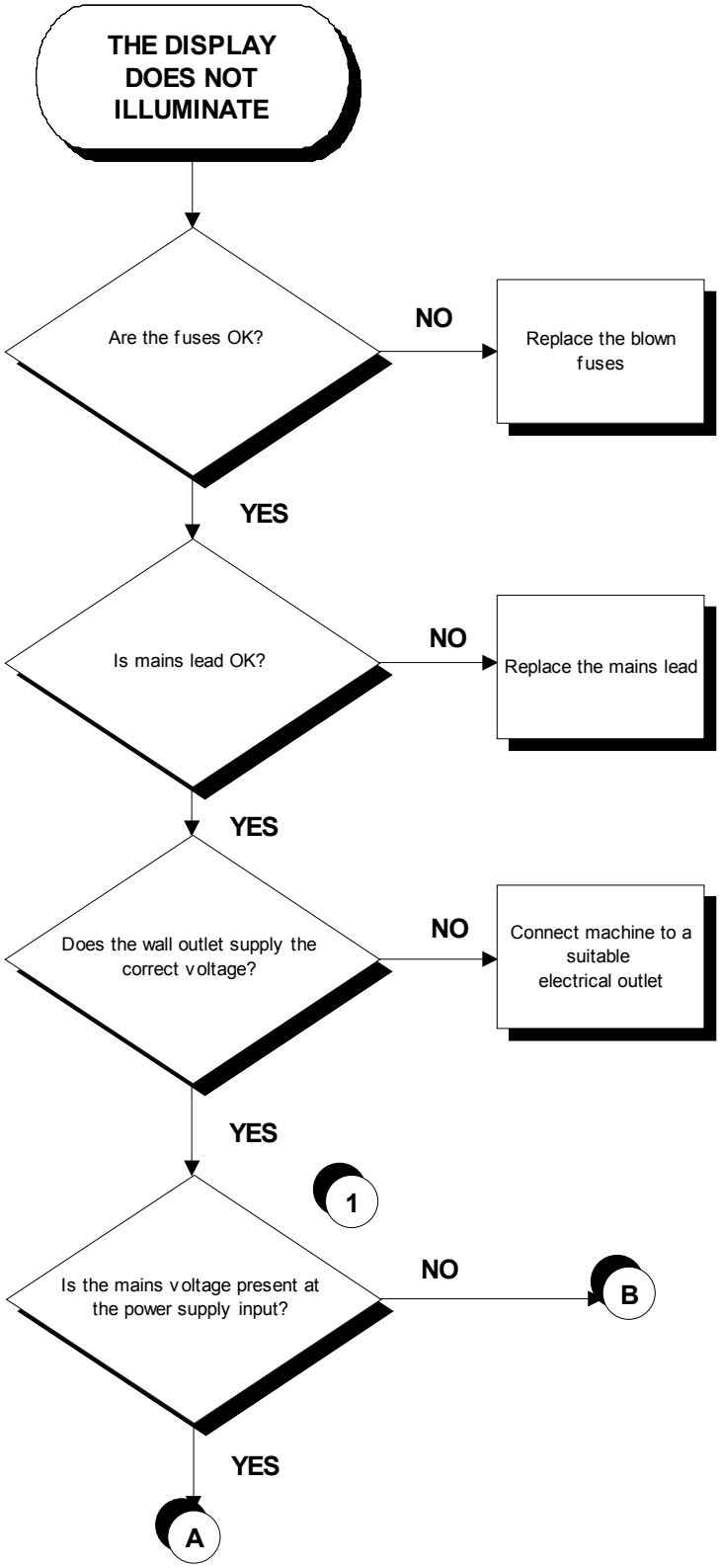
1. Check whether the problem has been resolved;
2. If the problem persists, it is recommended to resume the troubleshooting procedure from the point before the action was carried out.

A circled number (such as that shown on the left) next to a box of the troubleshooting procedure indicates that detailed instructions for performing that particular check or action are provided below the flowchart.

A circled letter (such as that shown on the left) is used to highlight a point in the procedure. Typically, this indicator is used in page changes.

6.1. THE DISPLAY DOES NOT ILLUMINATE

This problem occurs when the supply voltage fails to reach the display.



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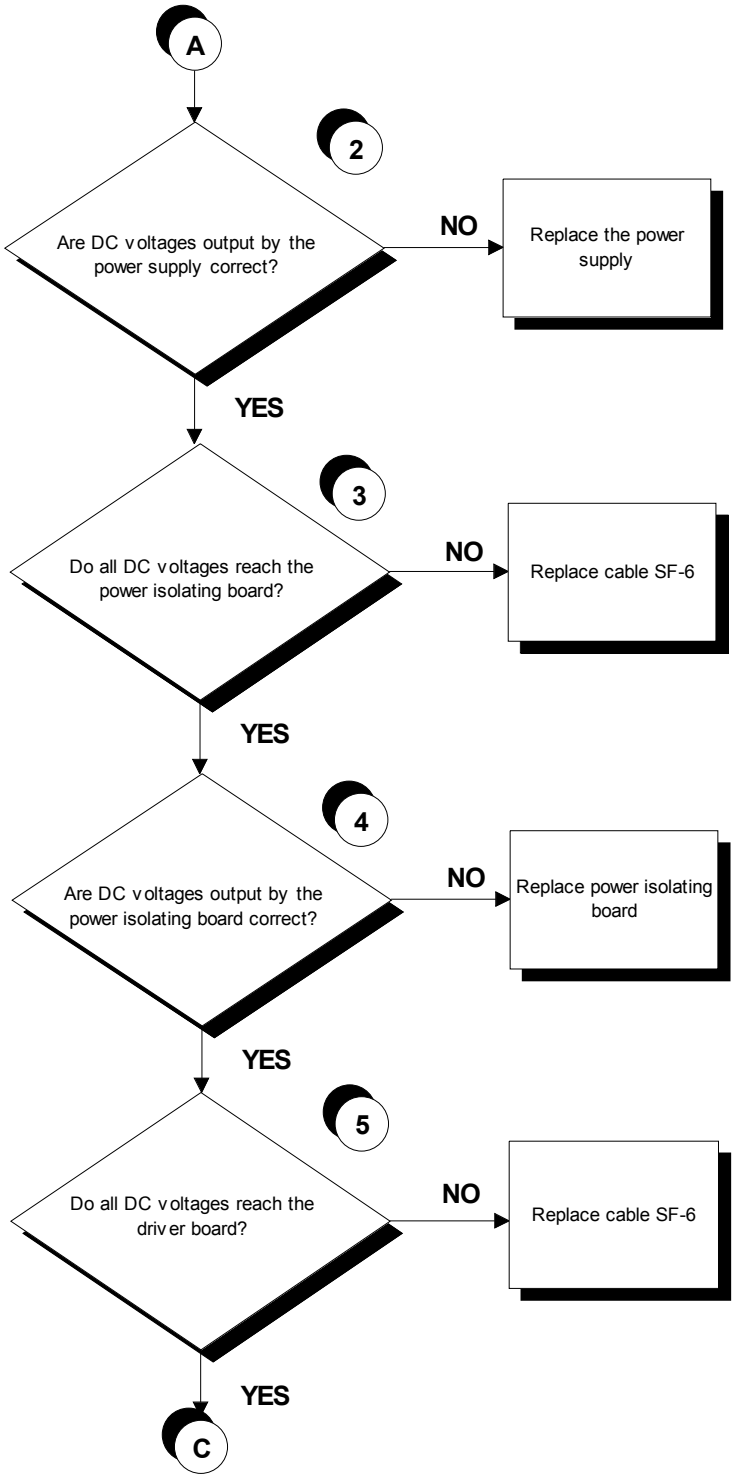

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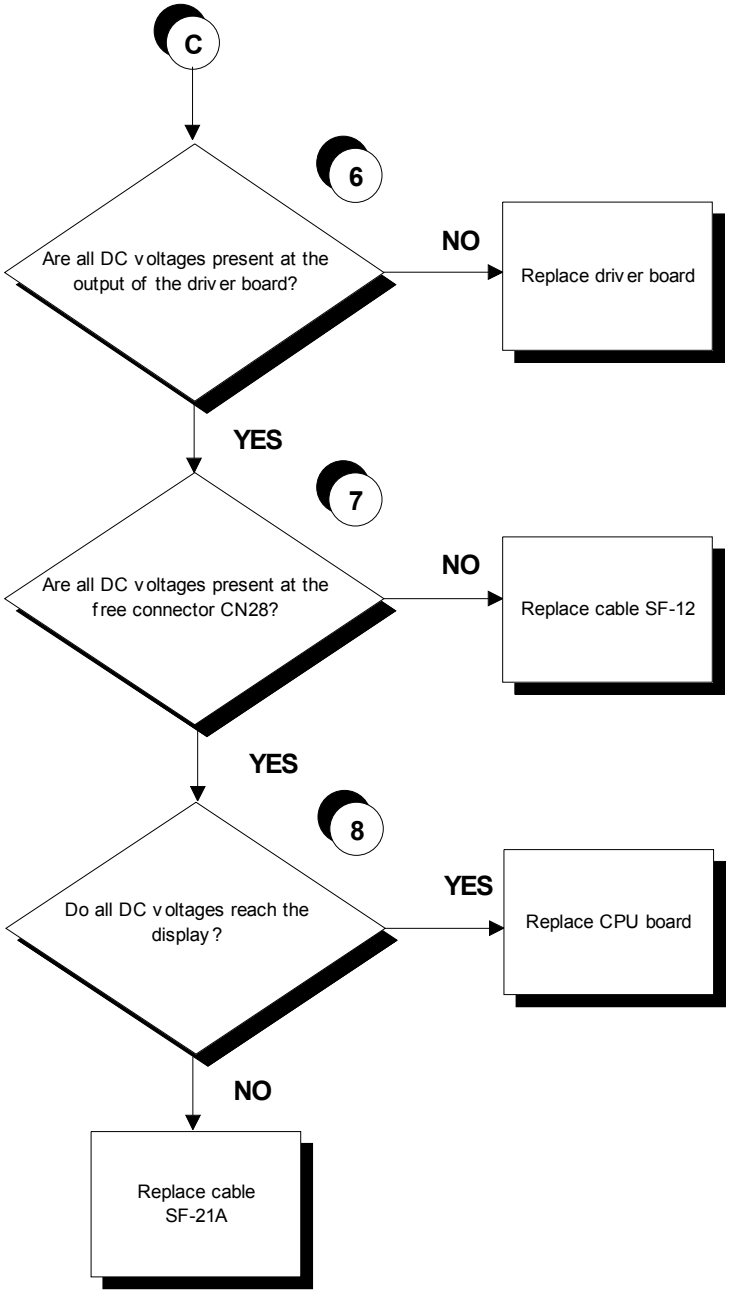

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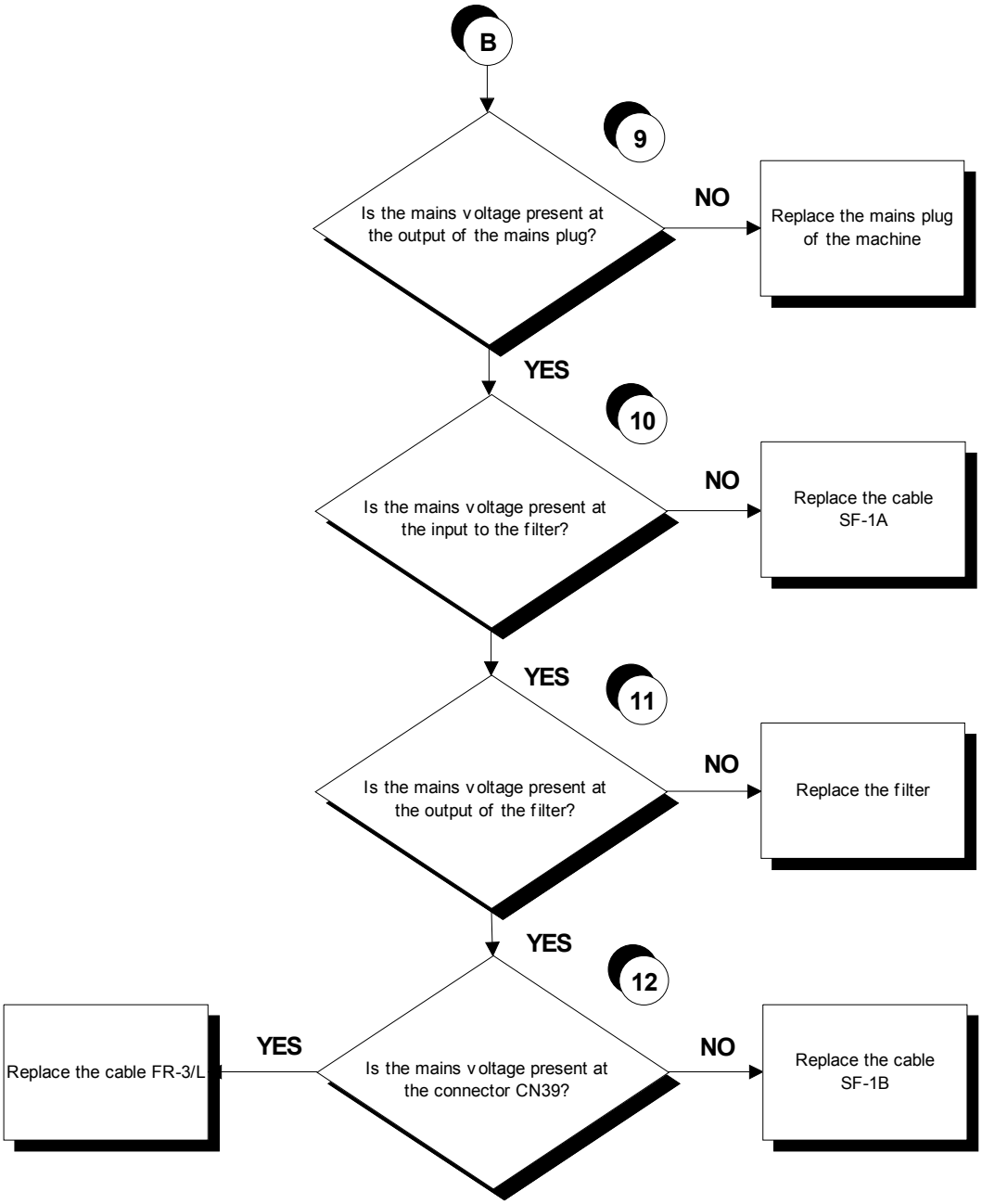


Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

WARNING: Carry out these checks with the machine powered up.

(1) Lift connector CN1 slightly from the power supply. Place the tester probes between pins 4 and 6 on the same connector. The measured voltage should be 220 VAC.

(2) Lift connector CN2 slightly from the power supply, in order to reach the pins with the tester probes. Check that all the output voltages of the power supply are correct, referring to paragraph 2.5. .

(3) As for step (2), but on connector J2 of the power isolating board.

(4) As for step (3).

(5) As for step (2), but on connector J3 of the driver board.

(6) As for step (2), but on connector J4 of the driver board.

(7) As for step (2), but on portable connector CN28.

(8) As for step (2), but on connector K1 on the CPU board of the display.

(9) Slightly lift up the fast ons on the machine power inlet socket. Place the tester probes between the live and neutral pins on the same connector. The measured voltage should be 220 VAC.

(10) As for step (9), but on the filter input.

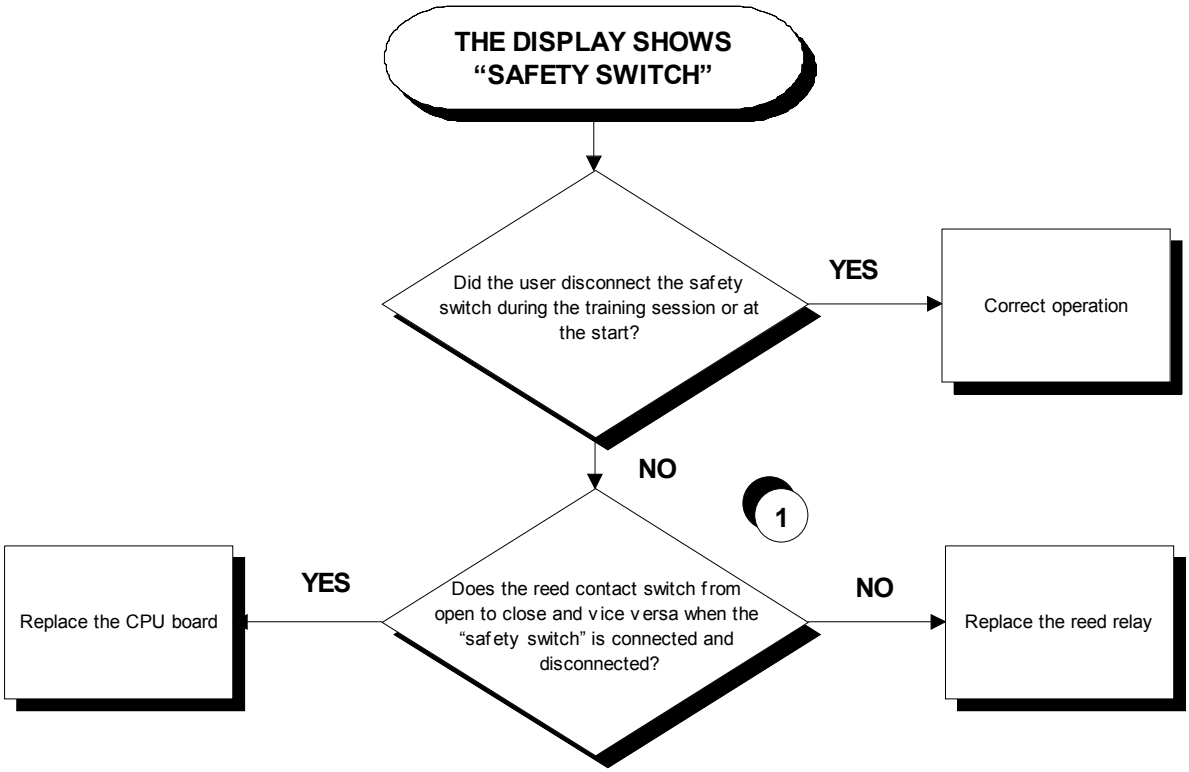
(11) As for step (9), but on the filter output.

(12) As for step (9), but on connector CN39.

6.2. THE DISPLAY SHOWS "SAFETY SWITCH"

The machine displays this message if:

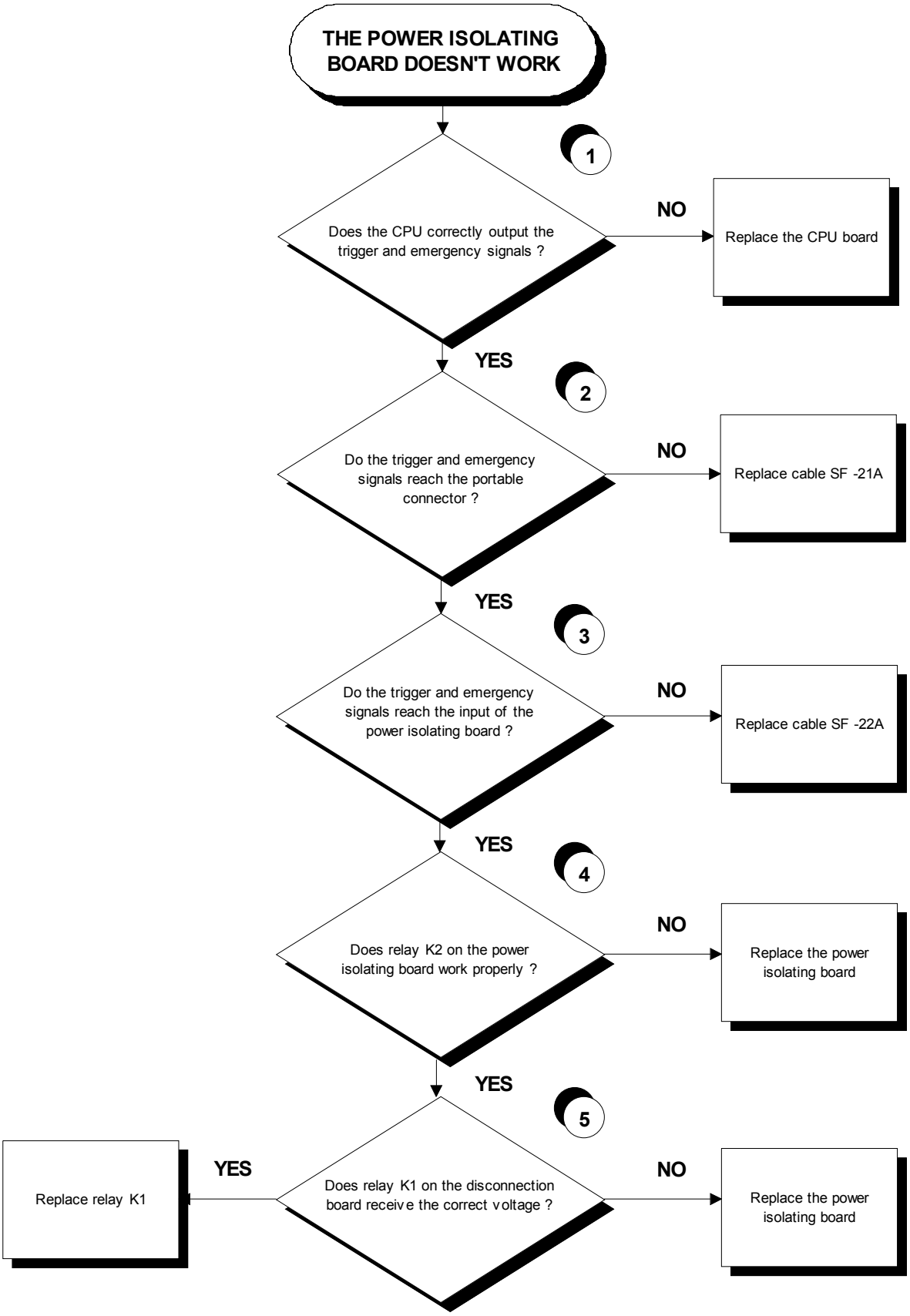
- The "Safety switch" is tripped during a training session.
- The emergency system is damaged.



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Place the tester probes between pins 1 and 2 of connector EM on the CPU board. The contact should be closed when the Safety switch is correctly positioned on the display, and open when the Safety switch is detached from the display.

6.3. THE POWER ISOLATING BOARD IS NOT WORKING



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

WARNING: Carry out these checks with the machine powered up.

(1) Place the tester probes across pins 4 and 5 of connector K16 on the CPU board to check the trigger signal. If the board is working properly the signal should be 4.4 Vdc with 0 Vdc pulses and a frequency of 63 Hz. If the emergency is activated the signal will be constantly at 4.4 Vdc.
Place the tester probes across pins 3 and 5 of connector K16 on the CPU board to check the emergency signal. If the board is working properly the signal should be 0 Vdc, otherwise it will be 5 Vdc.

(2) Place the tester probes across pins 4 and 5 of portable connector CN31 to check the trigger signal. If the board is working properly the signal should be 4.4 Vdc with pulses of 0 Vdc and a frequency of 63 Hz. If the emergency is activated the signal will be constantly at 4.4 Vdc.
Place the tester probes across pins 3 and 5 of portable connector CN31 to check the emergency signal. If the board is working properly the signal should be 0 Vdc, otherwise it will be 5 Vdc.

(3) Place the tester probes across pins 4 and 5 of connector J7 on the power isolating board to check the trigger signal. If the board is working properly the signal should be 4.4 Vdc with 0 Vdc pulses and a frequency of 63 Hz. If the emergency is activated the signal will be constantly at 4.4 Vdc.
Place the tester probes across pins 3 and 5 of connector J7 on the power isolating board to check the emergency signal. If the board is working properly the signal should be 0 Vdc, otherwise it will be 5 Vdc.

(4) Place the tester probes on pins 1 of connectors J5 and J6 on the power isolating board and check the signal continuity.
Perform the same operation on pins 2 of connectors J5 and J6 of the power isolating board.

(5) Place the tester probes across pins 0 and 1 of relay K1 on the power isolating board and check that the voltage is 12 Vdc.

6.4. THE DISPLAY SHOWS “E 3”

The machine displays this message if:

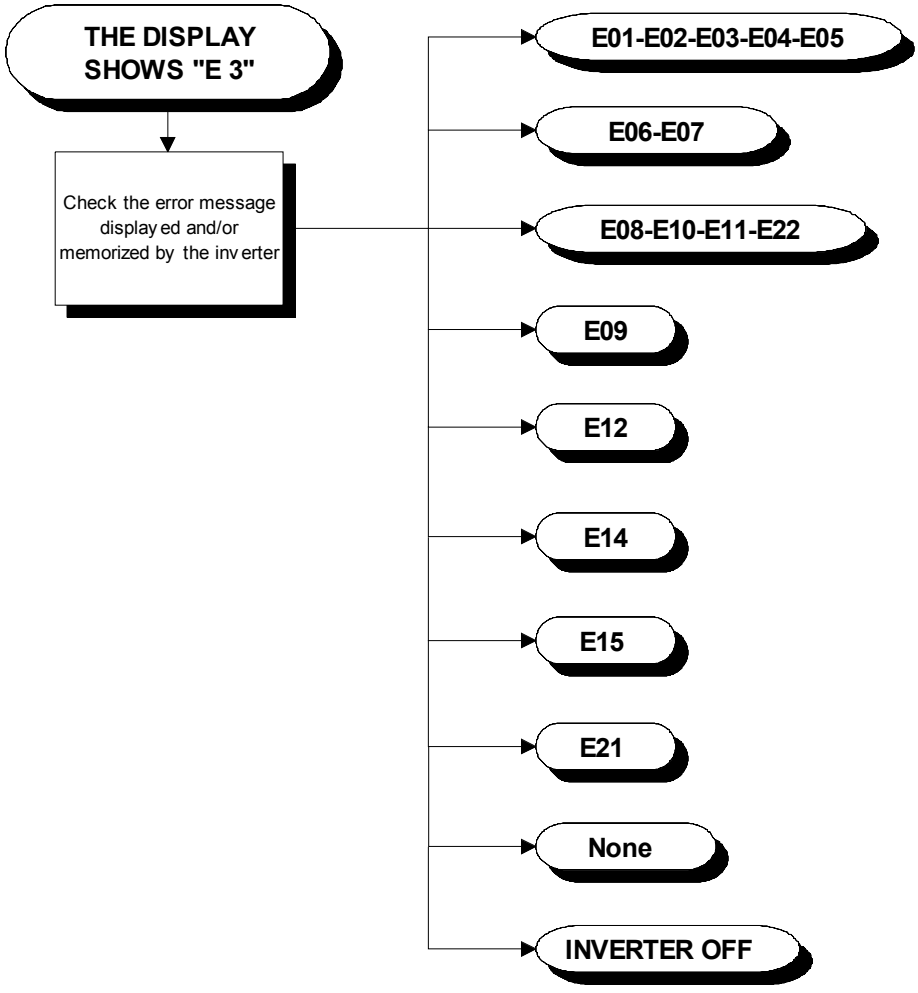
- it has detected a failure to actuate movement of the belt motor at the start of the training session;
- the movement of the belt motor is interrupted during the training session;
- the power supply to the inverter is cut off by the power isolating board.

The most common causes are principally:

- One of the motor thermal cutouts has been tripped;
- The inverter has shut down for protection from a mains voltage fluctuation (spike or glitch).

In both cases it is recommended to turn off the machine for at least one hour in the first case, and for a few minutes in the second case before resuming normal operation.

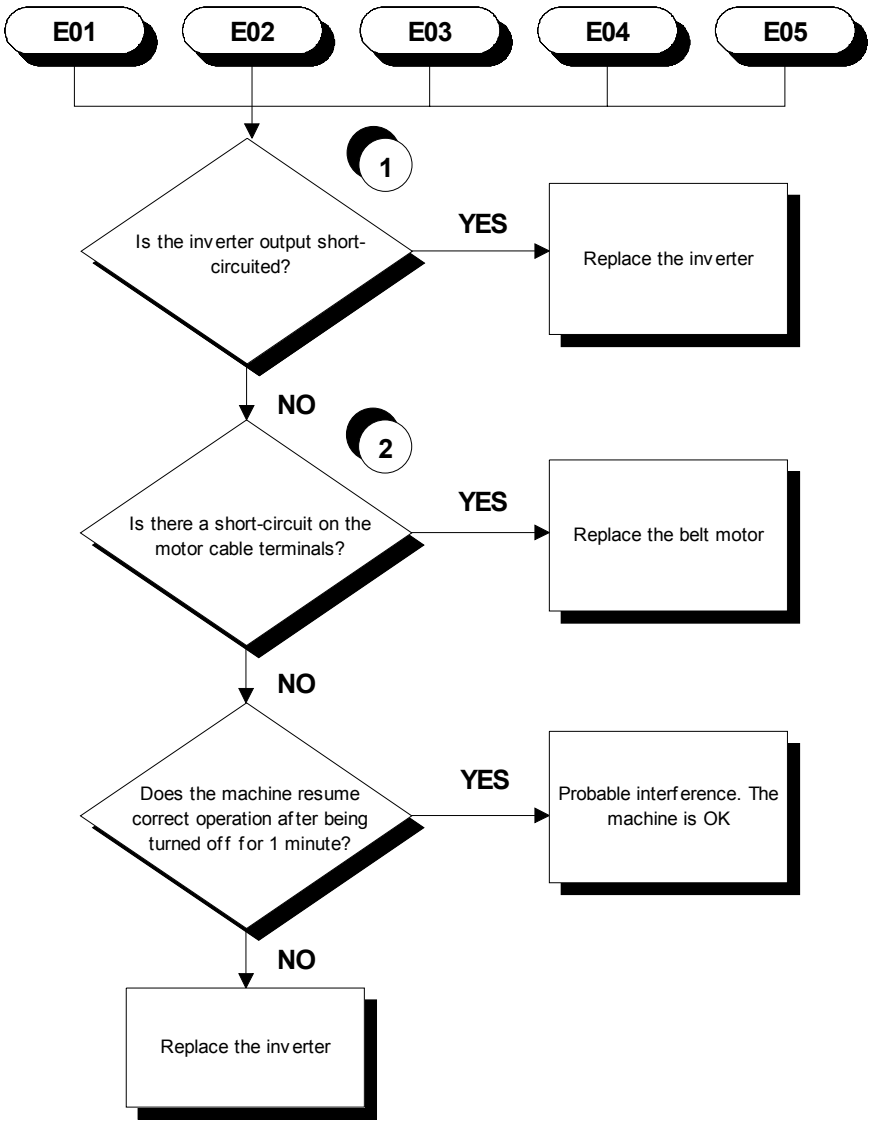
If the machine still does not operate correctly, follow the procedures (which differ depending on the inverter model used) set out in the following paragraphs.



The following paragraphs describe the troubleshooting procedures associated with the individual errors.

6.4.1. THE INVERTER DISPLAY SHOWS E01, E02, E03, E04 OR E05

These inverter error messages are related to output short-circuit problems.



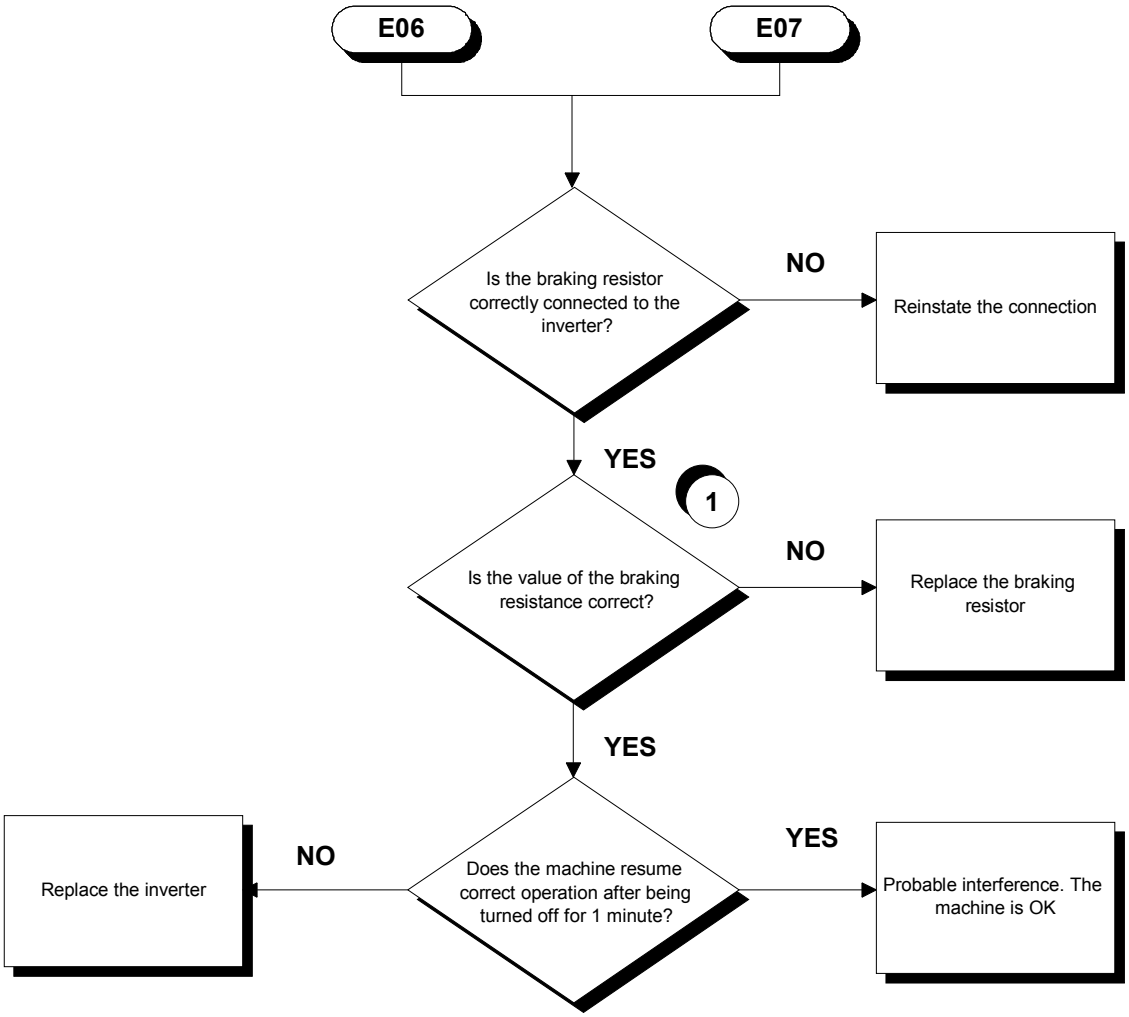
Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Disconnect the motor cable from the inverter and place the tester probes between its U-V, U-W and V-W terminals. The measured resistance should be very high, in the order of MOhm. It is difficult to make a stable measurement of resistance, however a phase can be considered short circuited or defective when the measured resistance is in the order of a few tens of Ohms.

(2) Place the tester probes between the blue – black, blue – brown and black – brown conductors of the motor cable. The measured resistance should be 3.3 Ohm.

6.4.2. THE INVERTER DISPLAY SHOWS E06 OR E07

These inverter error messages are related to problems with the inverter braking group or the braking resistor.



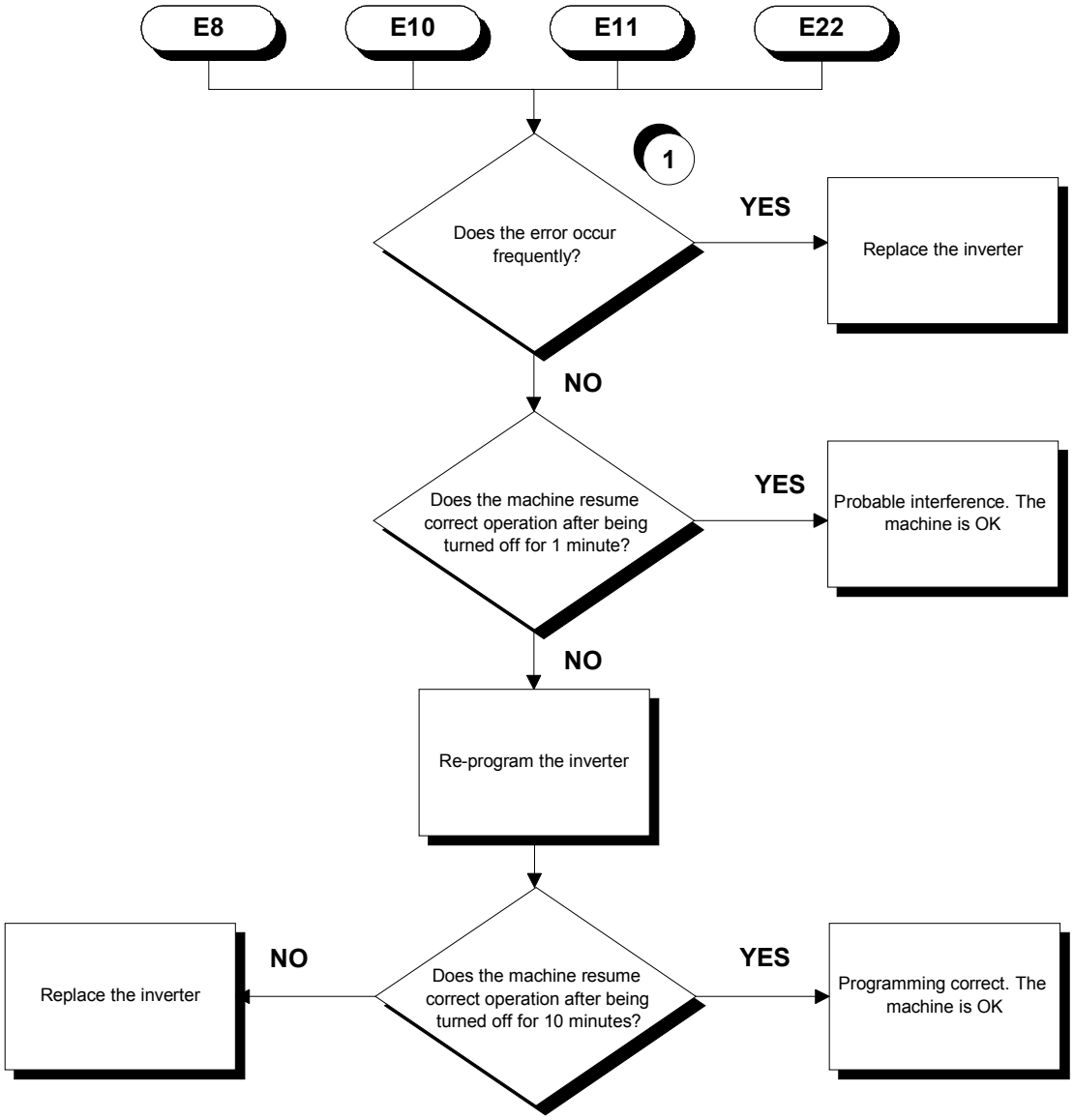
Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) With the machine switched off, disconnect a resistor terminal from the inverter terminal block and place the tester probes across it. The measured resistance should be 150 Ohm.

To reduce the occurrences of error E06, adjust inverter parameter b90, increasing its setting from the default value to 20. This adjustment allows the inverter to increase its use of the braking resistor.

6.4.3. THE INVERTER DISPLAY SHOWS E08, E10, E11 OR E22

These inverter error messages are related to HW and SW problems with the inverter.



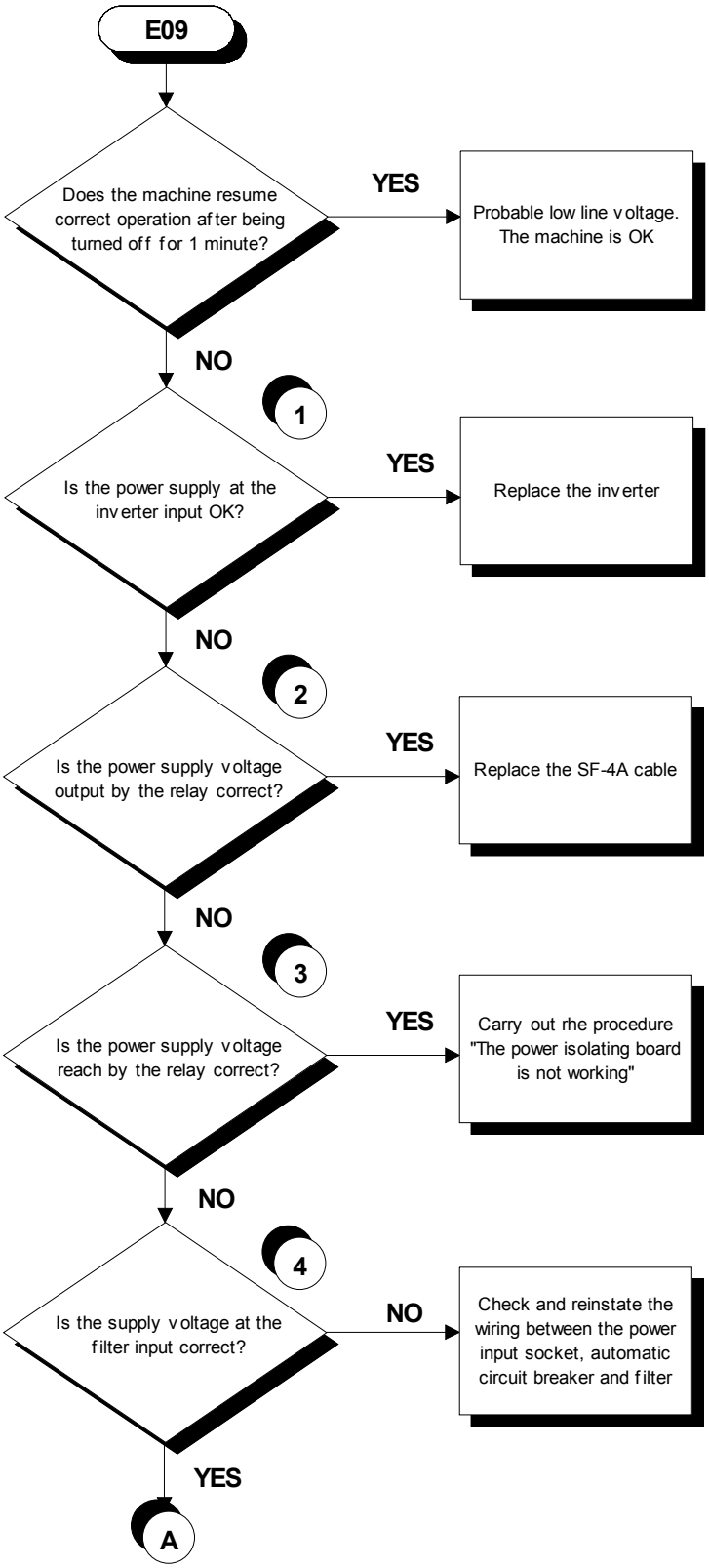
Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Check the frequency of the errors by counting the occurrences in the inverter error memory, and running targeted checks. An error is considered frequent if it occurs 2 or 3 times a day.

WARNING: incorrect programming of the inverter can cause serious damage to the machine or malfunctioning that is potentially hazardous to the user. Therefore, attempt this operation only if certain of being able to carry out the procedure with the latest SW version.

6.4.4. THE INVERTER DISPLAY SHOWS E09

This inverter error message is related to low line voltage problems on the inverter power supply.



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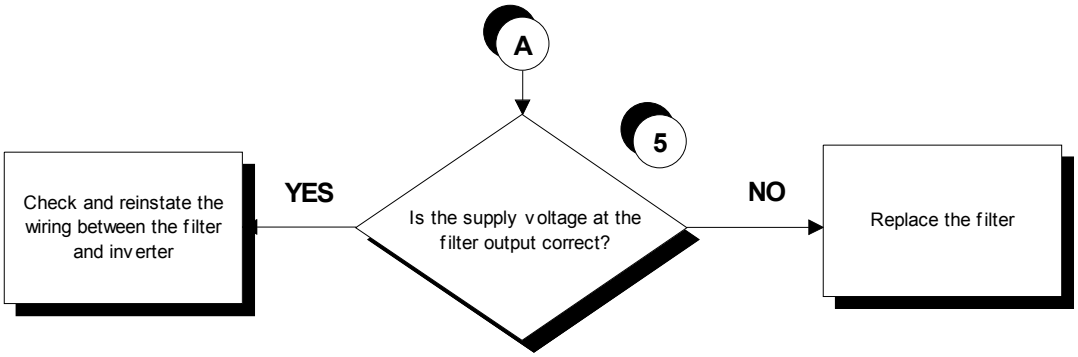


Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Place the tester probe between terminals L1 and N on the inverter. The measured value should be 220 VAC.

(2) Place the tester probe between fastons 2 and 6 of the K1 relay on the power isolating board. The measured value should be 220 VAC.

(3) Place the tester probe between fastons 4 and 8 of the K1 relay on the power isolating board. The measured value should be 220 VAC.

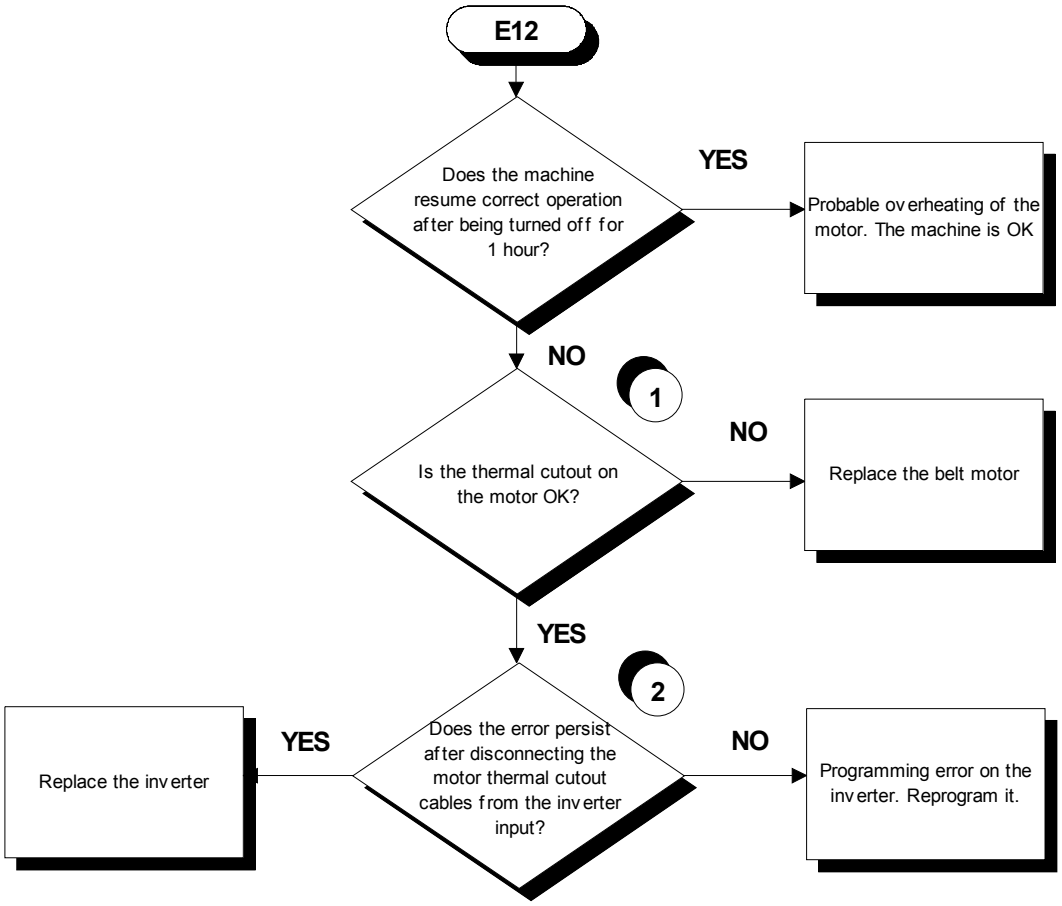
(4) Disconnect the filter supply cables and place the tester probes across them. The measured voltage should be 220 VAC.

(5) Disconnect the filter output cables and place the tester probes across the filter terminals. The measured voltage should be 220 VAC.

This error may be generated even by brief drops in the line voltage due to overloads or other causes. Therefore, it can be very useful to check the value of the mains voltage recorded in the inverter memory at the time when the error occurred. To obtain the mains voltage, the displayed value must be divided by 0.141 .

6.4.5. THE INVERTER DISPLAY SHOWS E12

This inverter error message is related to the opening of the motor thermal cutouts.



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

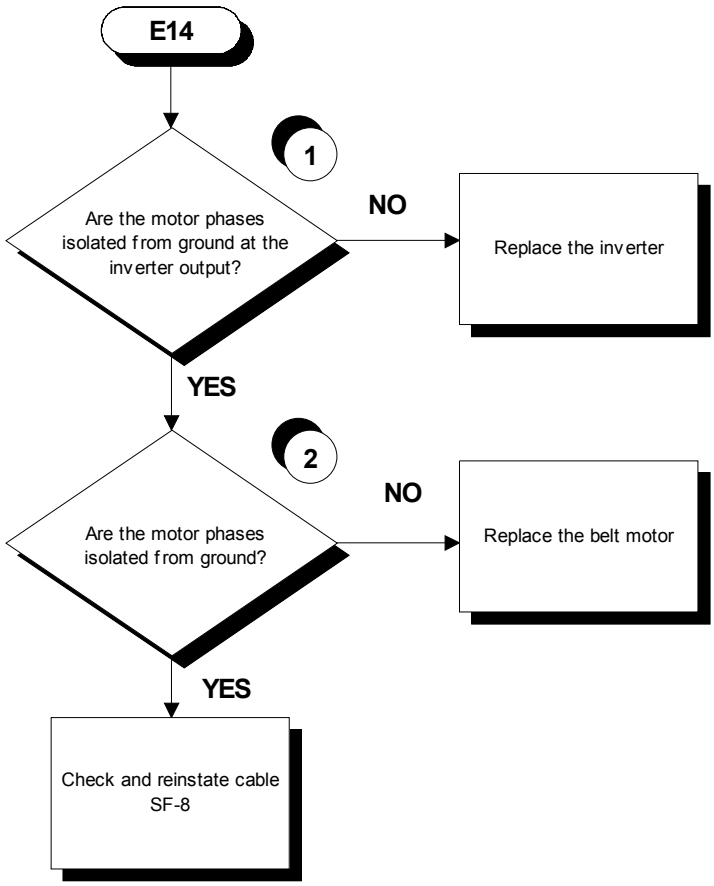
(1) Disconnect the motor thermal cutout cables from the inverter and place the tester probes across them. The measured resistance should be less than 1 Ohm.

In some cases the value may be higher due to oxidation of the contacts. To reinstate correct operation, it is necessary to perform a special operation which will be described to you on contacting the Technogym Service.

(2) Disconnect the motor thermal cutout from the inverter: pin P24 and 3.

6.4.6. THE INVERTER DISPLAY SHOWS E14

This inverter error message is related to poor isolation between the motor phases and ground.



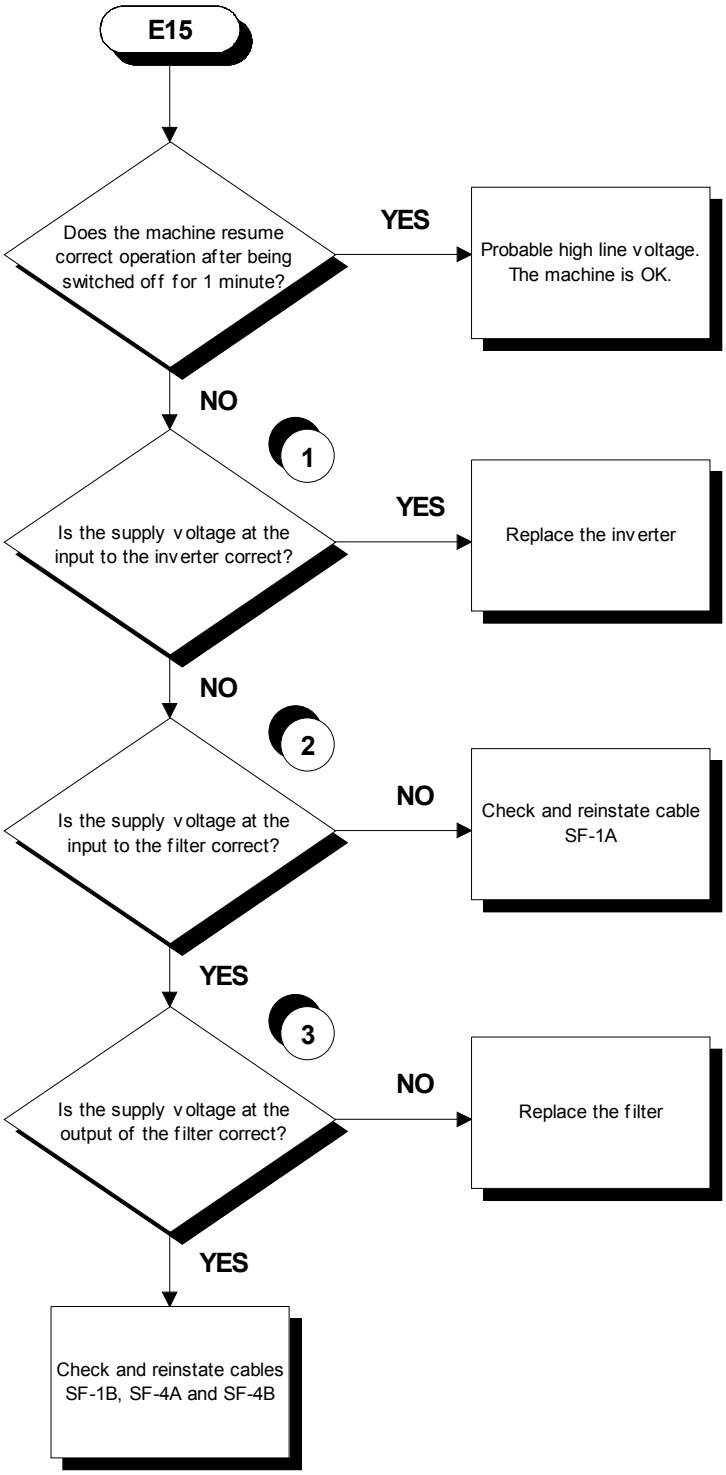
Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Disconnect the motor cable from the inverter and place the tester probes between terminals U, V and W of the inverter and the earth screw of the inverter. The measured resistance should be in the order of MOhms or higher.

(2) Disconnect the motor cable from the motor and place a tester between its terminals U, V and W and the earth screw of the inverter. The measured resistance should be in the order of MOhms or higher.

6.4.7. THE INVERTER DISPLAY SHOWS E15

This inverter error message is caused by high voltage problems on the inverter power supply line.



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Insert the tester probes between terminals L1 and N of the inverter. The measured voltage should be 220 VAC.

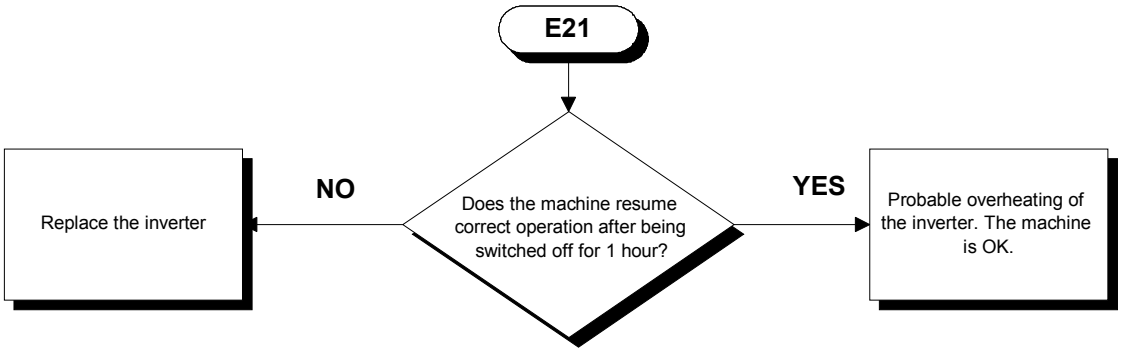
(2) Disconnect the supply cables from the filter and place the tester probes across them. The measured voltage should be 220 VAC.

(3) Disconnect the filter output cables and place the tester probes across the filter terminals. The measured voltage should be 220 VAC.

This error may be generated even by brief drops in the line voltage due to overloads or other causes. Therefore, it can be very useful to check the value of the mains voltage recorded in the inverter memory at the time when the error occurred. To obtain the mains voltage, the displayed value must be divided by 0.141.

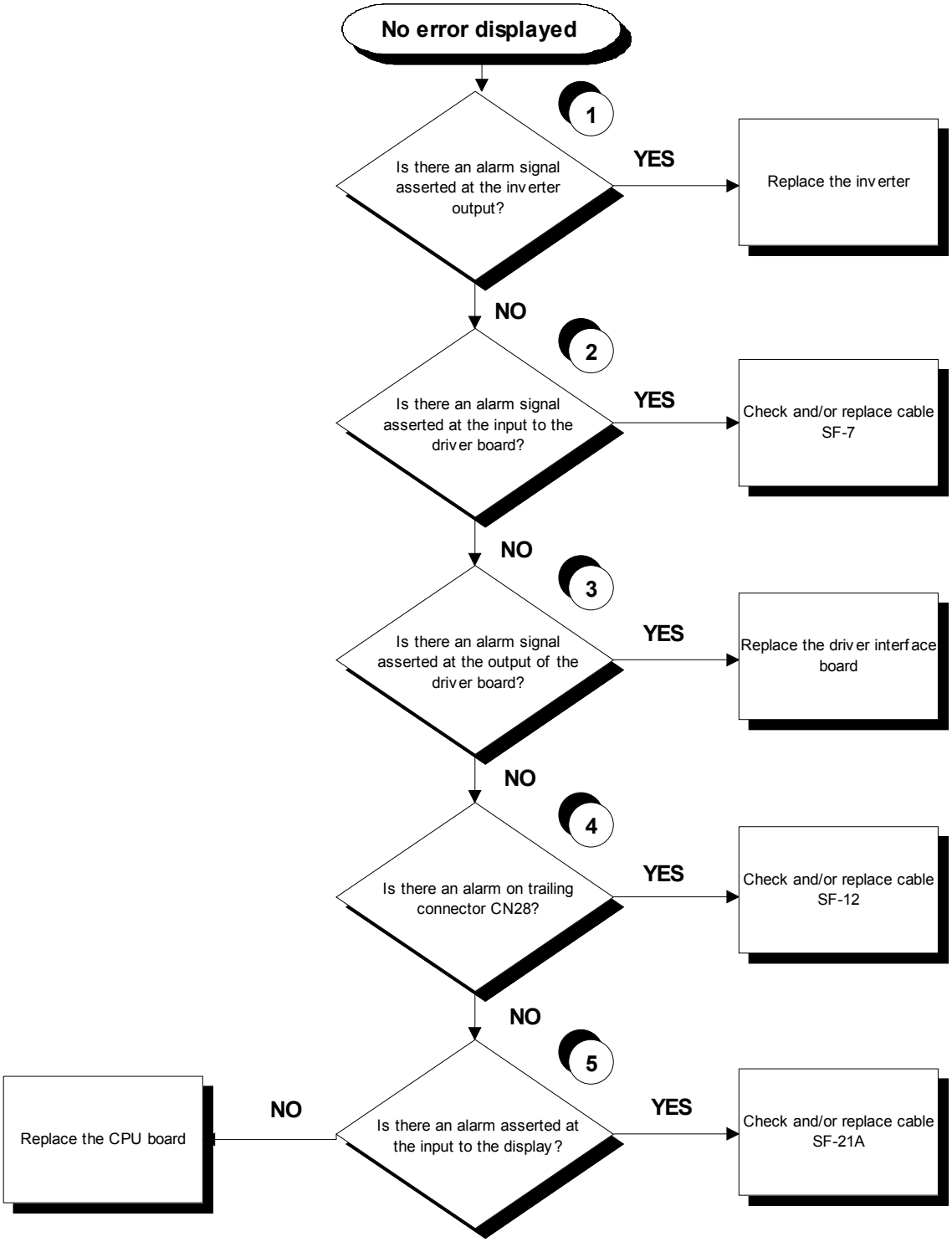
6.4.8. THE INVERTER DISPLAY SHOWS E21

This inverter error message is associated with problems of high inverter temperature.



6.4.9. THE INVERTER DISPLAY DOES NOT SHOW ANY ERROR

This is an anomalous error condition in which the machine display reports an error but the inverter has not generated an error.



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Place the tester probes between terminals AL1 and AL0 of the inverter. The measured voltage should be 5 Vdc in the alarm condition, and 0 Vdc in normal conditions.

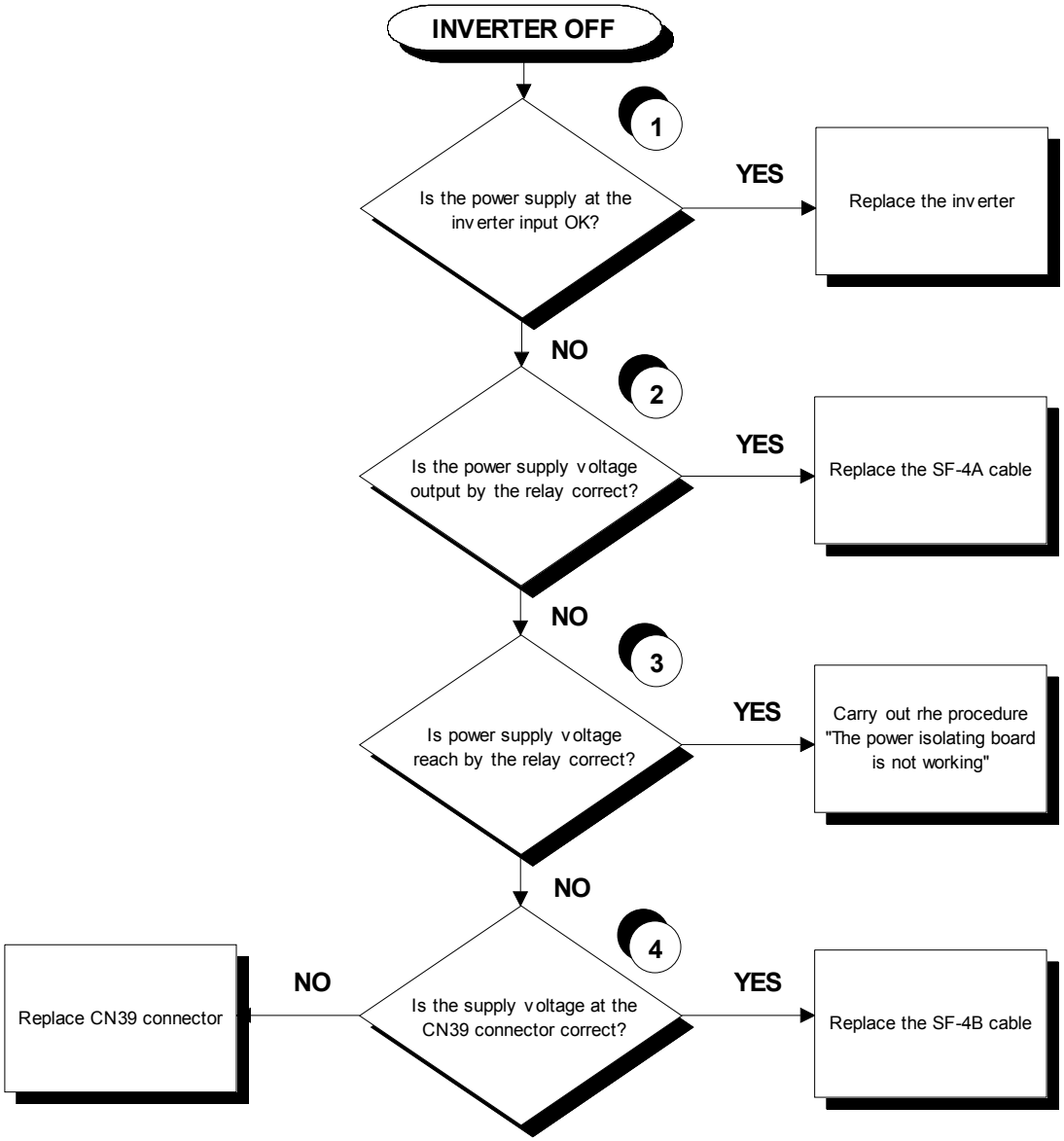
(2) As for step (1), but between pins 3 (signal) and 4 (ground) of connector J5 on the driver board.

(3) As for step (1) but between pins 8 (signal) and 12 (ground) of connector J6 on the driver board.

(4) As for step (1) but between pins 11 (signal) and 12 (ground) of portable connector CN28.

(5) As for step (1) but between pins 8 (signal) and 12 (ground) of connector K4 on the CPU board.

6.4.10. THE INVERTER IS OFF



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Place the tester probe between terminals L1 and N on the inverter. The measured value should be 220 VAC.

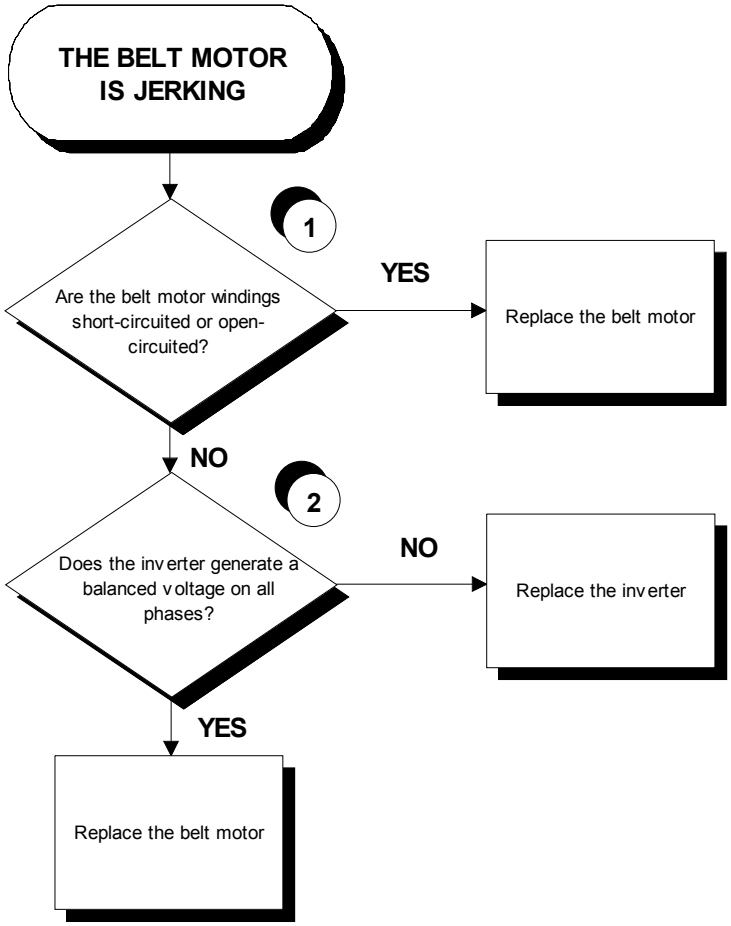
(2) Place the tester probe between fastons 2 and 6 of the K1 relay on the power isolating board. The measured value should be 220 VAC.

(3) Place the tester probe between fastons 4 and 8 of the K1 relay on the power isolating board. The measured value should be 220 VAC.

(4) Place the tester probe between terminals L and N on the CN39 connector. The measured voltage should be 220 VAC.

6.5. THE BELT MOTOR IS JERKING

The probable cause of this error is a disconnected phase on the motor or inverter output.



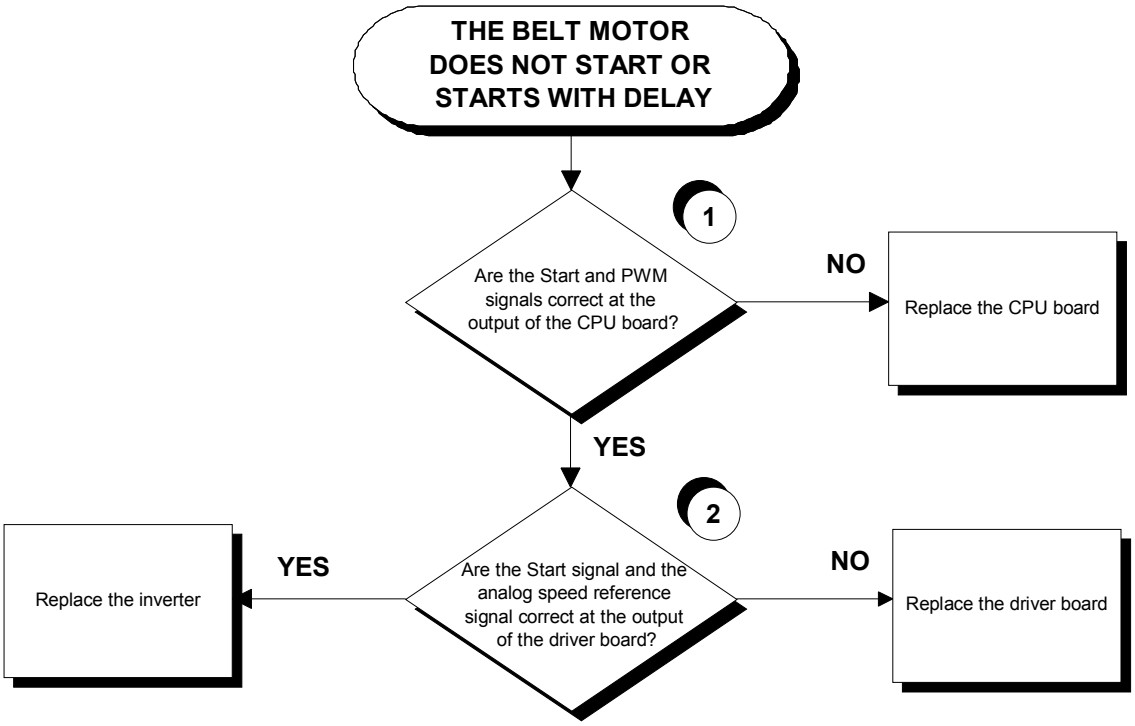
Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Disconnect the motor cable from the motor and place a tester across its terminals U-V, U-W and V-W. The measured resistance should be approximately 3.3 Ohm.

(2) Operate the machine at 8.3 Km/h and place a tester across its terminals U-V, U-W and V-W. The measured voltage should be 220 VAC.

6.6. THE BELT MOTOR STARTS WITH DELAY

The problem is caused by the inverter failing to receive the enable signal (Start) or the speed signal.



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

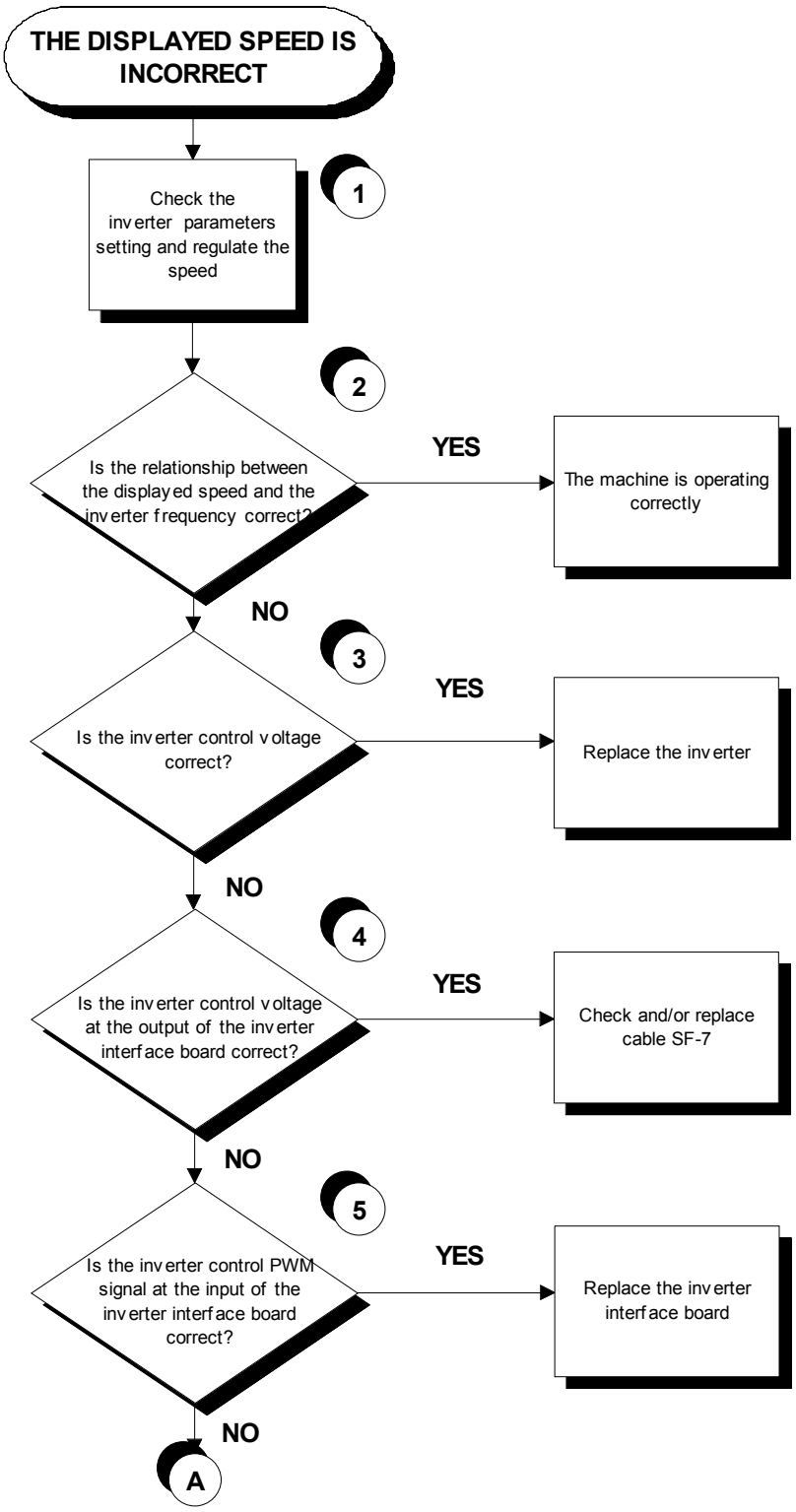
(1) To check the Start signal, place a tester between pins 6 (signal) and 12 (ground) of connector K4 on the CPU board. The measured voltage should be 0 Vdc when the tread-belt is stopped, and 4.8 Vdc immediately after pressing the "Start" key.
To check the PWM signal, place a tester between pins 4 (signal) and 12 (ground) of connector K4 on the CPU board. The measured voltage should be 5 Vdc when the tread-belt is stopped, whereas immediately after pressing the "Start" key the reading should rapidly decrease until it reaches a fixed value corresponding to the selected speed. The variation of the signal should be accompanied by a corresponding variation in the tread-belt speed: see Table 6.7-1.

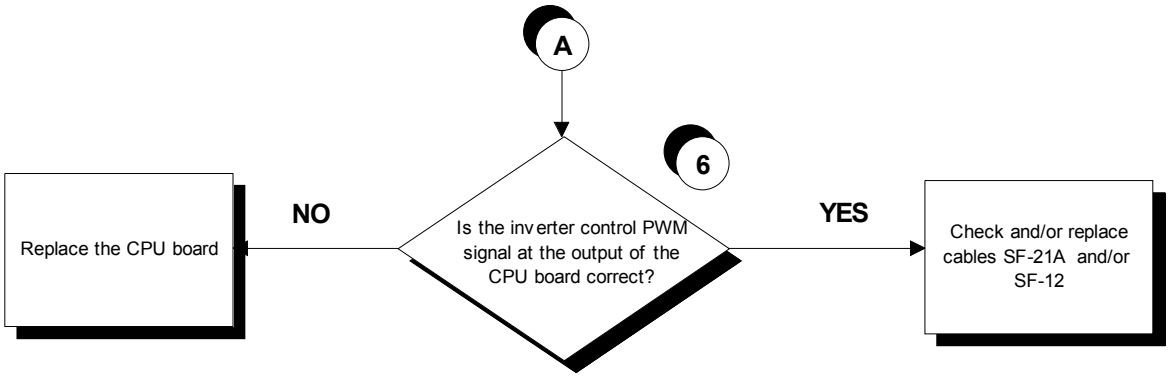
(2) To check the Start signal, place a tester between pin 2 (signal) and 1 (ground) of connector J5 on the driver board. When the tread-belt is stopped the reading should be -25 Vdc, and immediately after pressing the "Start" key it should be 0 Vdc.
To check analog speed reference signal, place a tester between pin 5 (signal) and 6 (ground) of connector J5 on the driver board. When the tread-belt is stopped the reading should be 0 Vdc, and immediately after pressing the "Start" key the value should increase rapidly to reach a fixed value corresponding to the selected speed. The variation of the signal should be accompanied by a corresponding variation in the tread-belt speed: see Table 6.7-1.

6.7. THE DISPLAYED SPEED IS INCORRECT

The machine displays this error if:

- the calibration is incorrect;
- there are HW problems with the CPU board – driver board – inverter and motor group.





Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) See paragraph 9.5. to set the inverter and 8.6. to regulate the speed.

(2) When the machine is in operation, check that the speed shown on the display and the inverter operating frequency are approximately those shown in the table below.

SPEED (Km/h)	PWM SIGNAL (Vdc)		ANALOG SIGNAL (Vdc)		FREQUENCY (Hz)
CPU BOARD		DRIVER BOARD		INVERTER	
DISPLAY	4-12/K4	4-12/J6	5-6/J5	O-L	DISPLAY
1.0	4.68	4.68	0.56	0.56	5.3
4.0	3.84	3.84	2.42	2.42	19.6
8.0	2.70	2.70	4.90	4.90	39.8
12.0	1.56	1.56	7.38	7.38	60
16.0	0.42	0.42	9.85	9.85	80

Table 6.7-1

(3) Place the tester probes between the 0 (signal) and L (ground) terminals of the inverter. Check that during machine operation the speed shown on the display and the voltage measured on the inverter correspond the values shown in Table 6.7-1.

(4) Place the tester probes between pins 5 (signal) and 6 (ground) of connector J5 on the driver board. Check that during machine operation the speed shown on the display and the voltage measured on the inverter correspond the values shown in Table 6.7-1.

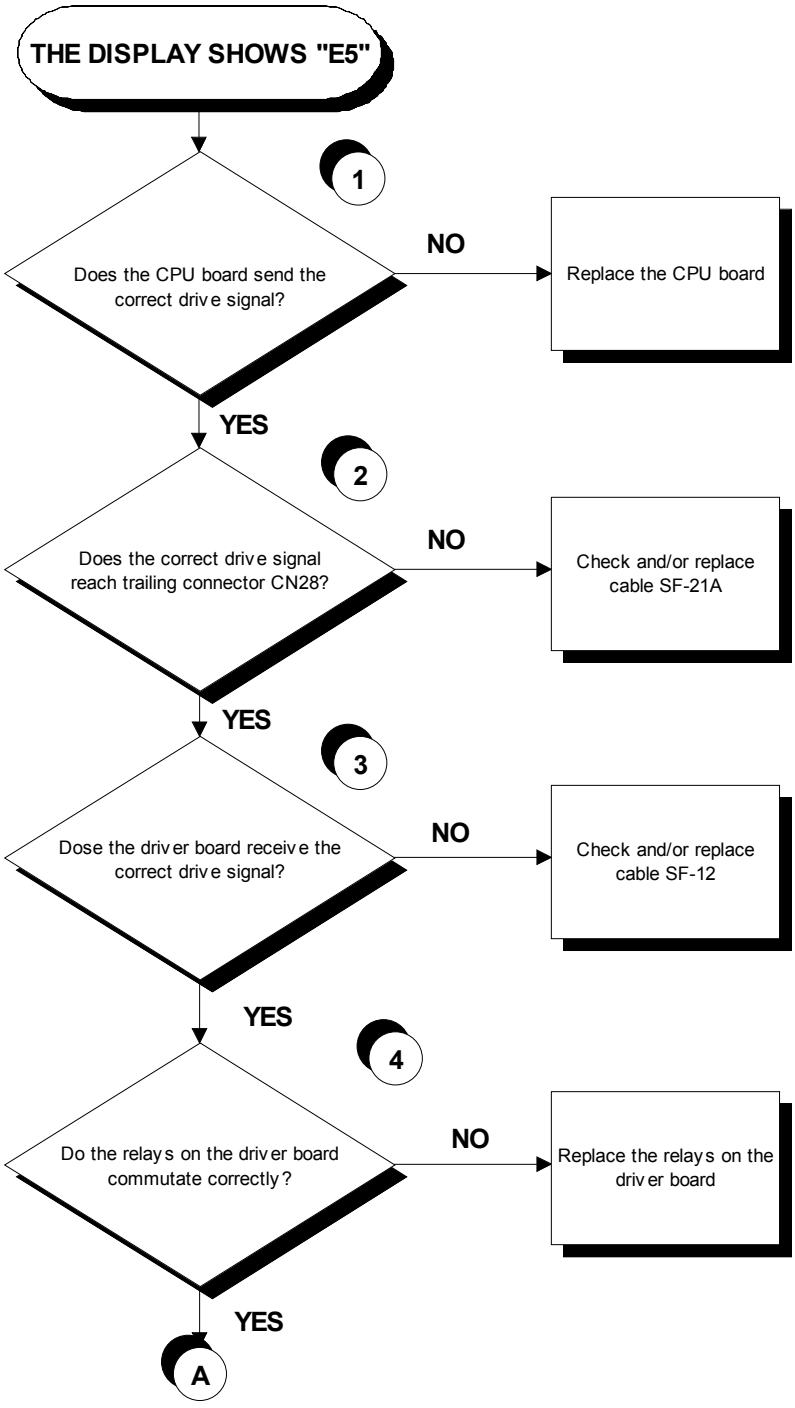
(5) Place the tester probes between pins 4 (signal) and 12 (ground) of connector J6 on the driver board. Check that during machine operation the speed shown on the display and the voltage measured on the inverter correspond the values shown in Table 6.7-1.

(6) Place the tester probes between pins 4 (signal) and 12 (ground) of connector K4 on the CPU board. Check that during machine operation the speed shown on the display and the voltage measured on the inverter correspond the values shown in Table 6.7-1.

6.8. THE DISPLAY SHOWS “E 5”

The machine displays this error if:.

- it receives an up-down motor alarm signal from the driver board;
- it fails to receive an encoder feedback signal after having actuated the motor;
- the power supply to the motor is cut off by the power isolating board.



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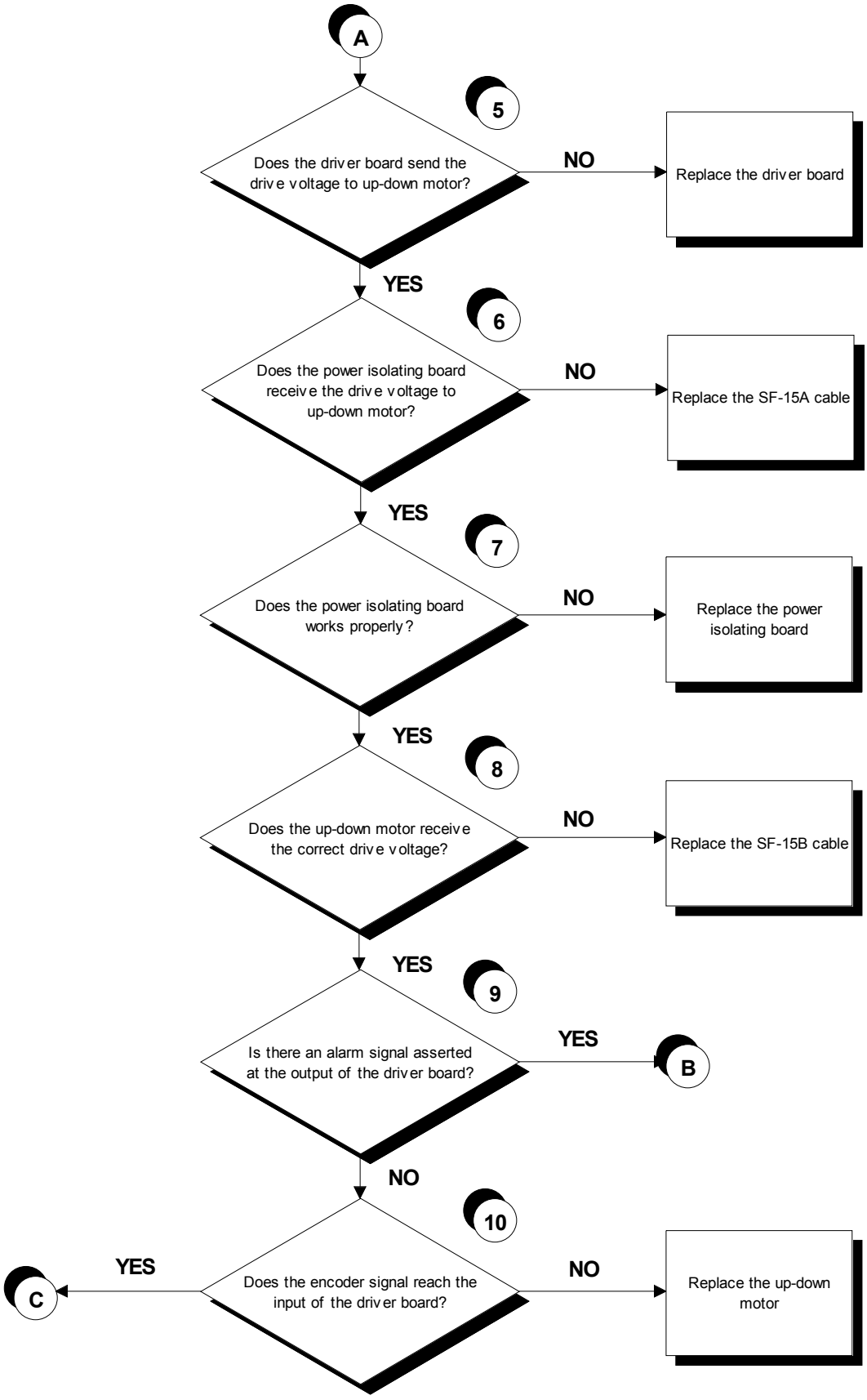

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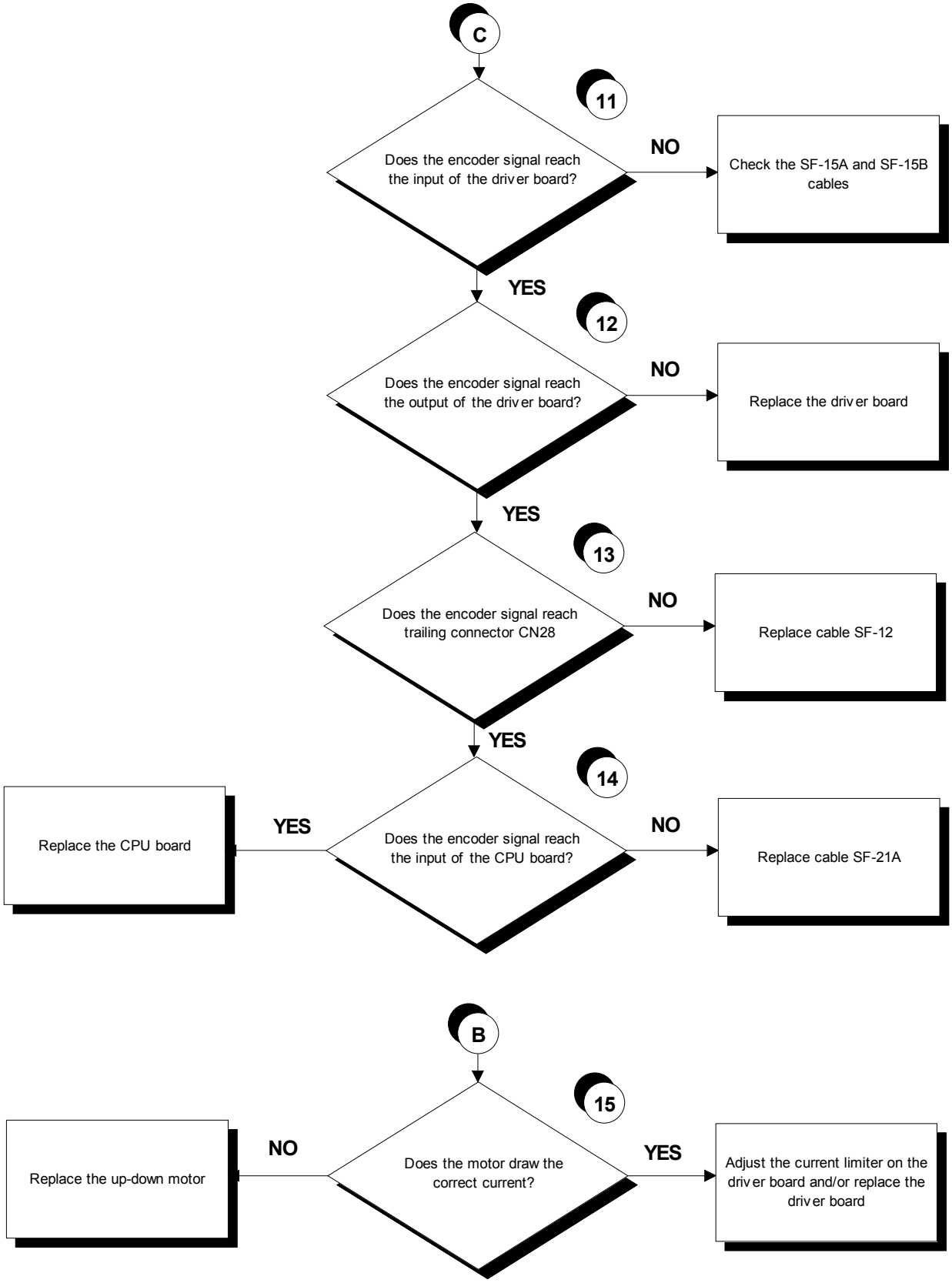

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Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

Execute the following operations procedure when the machine does the reset at the start up described at paragraph 3.3.2. "The reset procedure".

(1) Place the tester probes between pins 5 (signal) and 12 (ground) of connector K4 on the CPU board. When the machine goes up the measured voltage should be approximately 4.65 Vdc. Place the tester probes between pins 3 (signal) and 12 (ground) of connector K4 on the CPU board. When the machine goes down the measured voltage should be approximately 4.65 Vdc.

(2) Place the tester probes between pins 2 (signal) and 12 (ground) of portable connector CN28. When the machine goes up the measured voltage should be approximately 4.65 Vdc. Place the tester probes between pins 1 (signal) and 12 (ground) of portable connector CN28. When the machine goes down the measured voltage should be approximately 4.65 Vdc.

(3) Place the tester probes between pins 5 (signal) and 12 (ground) of connector J6 on the driver board. When the machine goes up the measured voltage should be approximately 4.65 Vdc. Place the tester probes between pins 3 (signal) and 12 (ground) on connector J6 of the driver board. When the machine goes down the measured voltage should be approximately 4.65 Vdc.

(4) Check for the click of the relay.

(5) Place the tester probes between pins 1 and 2 of connector J1 on the driver board. When the elevation changes the absolute measured value should be approximately 20-24 Vdc.

(6) Place the tester probes between pins 1 and 2 of connector J5 on the power isolating board. When the elevation changes the absolute measured value should be approximately 20-24 Vdc.

(7) Execute the procedure described at paragraph 6.3. "The power isolating board is not working".

(8) Place the tester probes between pins 1 and 2 of portable connector CN46. When the elevation changes the absolute measured value should be approximately 20-24 Vdc.

(9) Place the tester probes between pin 7 (signal) and 12 (ground) of connector J6 on the driver board. The signal is normally 5 Vdc and there is a 0 Vdc pulse lasting a few msec if the board detects an alarm condition.

(10) Place the tester probes between pins 5 (signal) and 6 (ground) of portable connector CN46. It should be a square wave signal between 8.8 and 11.4 Vdc. The voltage measured with a multimeter will be approximately 10 Vdc.

(11) Place the tester probes between pins 5 (signal) and 6 (ground) of connector J1 on the driver board. There should be a square wave signal alternating between 8.8 and 11.4 Vdc. Using a tester, the reading should be approximately 10 Vdc.

(12) Place the tester probes between pins 9 (signal) and 11 (ground) of connector J6 on the driver board. There should be a square wave signal alternating between 0 and 5 Vdc. Using a tester, the reading should be 2.5 Vdc.

(13) Place the tester probes between pins 4 (signal) and 5 (ground) of portable connector CN28. There should be a square wave signal varying alternating 0 and 5 Vdc. Using a tester, the reading should be approximately 2.5 Vdc.

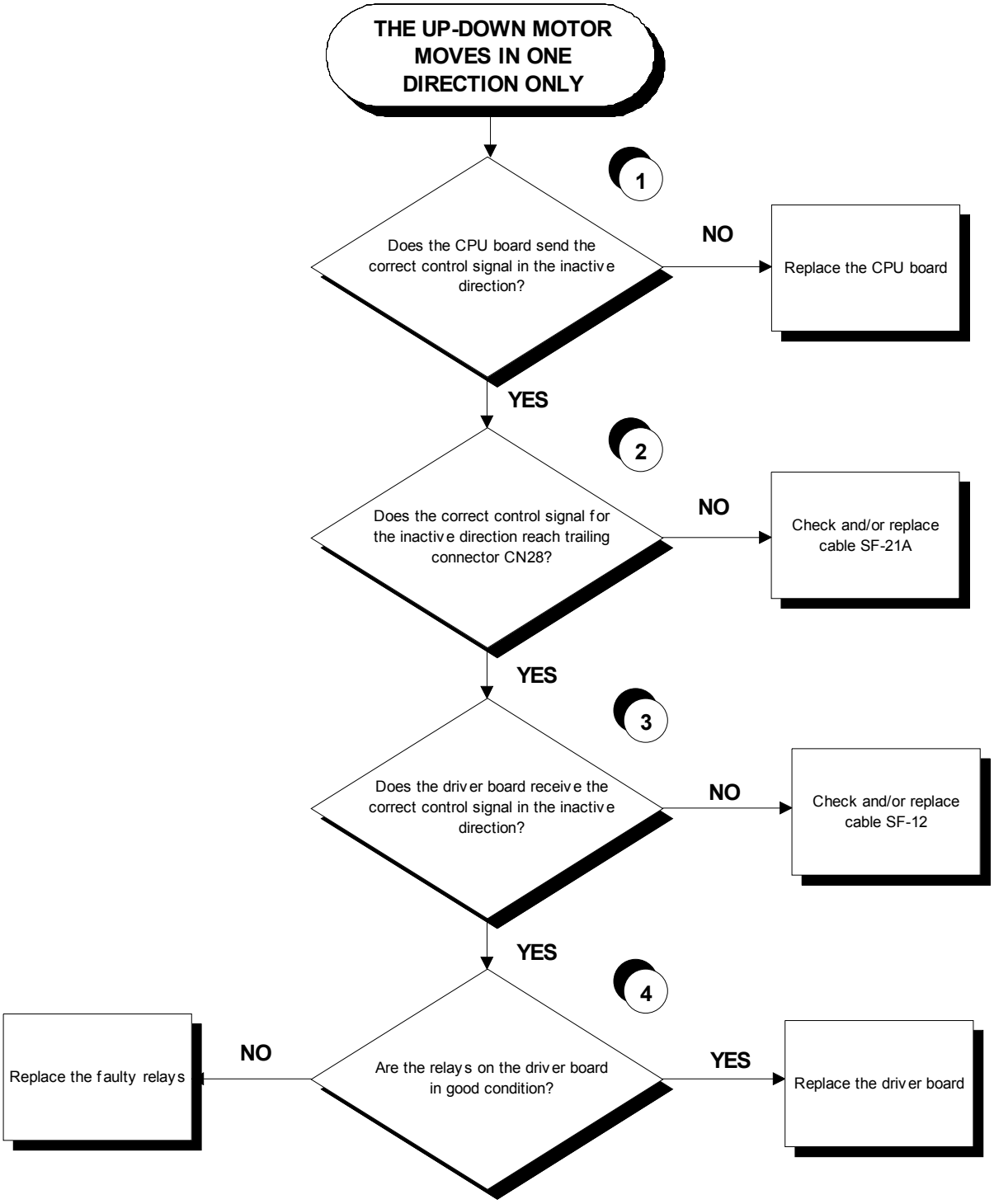
(14) Place the tester probes between pins 9 (signal) and 11 (ground) of connector K4 on the CPU board. There should be a square wave signal alternating between 0 an 5 Vdc. Using a tester, the reading should be approximately 2.5 Vdc.

(15) Place the tester probes in series with the motor cable. When the elevation changes the steady-state measured value should be less than 4-5 A.

6.9. THE UP-DOWN MOVES IN ONLY ONE DIRECTION

The machine displays this error if:

- a relay on the driver board is defective;
- the CPU board fails to send the enable signal;
- the driver board is not able to drive the motor.



Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

If it is not possible to perform the following operations with the "↑" "↓" keys directly, do so when the machine does the reset at the start up described at paragraph 3.3.2. "The reset procedure".

(1) Place the tester probes between pins 5 (signal) and 12 (ground) of connector K4 on the CPU board. Press the "↑" key: the measured value should be 4.65 Vdc. Place the tester probes between pins 3 (signal) and 12 (ground) of connector K4 on the CPU board. Press the "↓" key: the measured value should be approximately 4.65 Vdc.

(2) Place the tester probes between pins 2 (signal) and 12 (ground) of portable connector CN28. Press the "↑" key: the measured value should be approximately 4.65 Vdc. Place the tester probes between pins 1 (signal) and 12 (ground) of portable connector CN28. Press the "↓" key: the measured value should be approximately 4.65 Vdc.

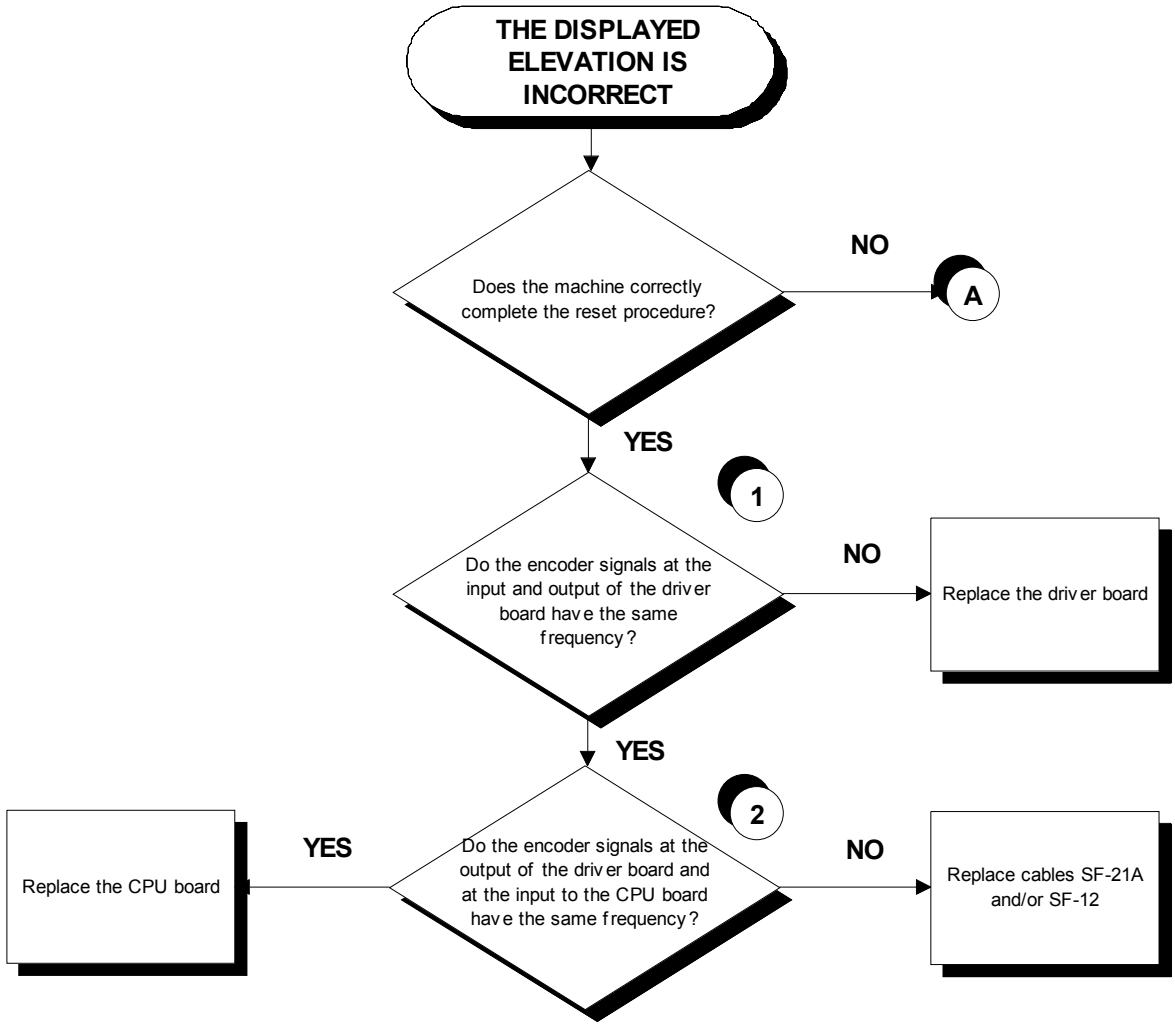
(3) Place the tester probes between pins 5 (signal) and 12 (ground) of connector J6 on the driver board. Press the "↑" key: the measured voltage should be 4.65 Vdc. Place the tester probes between pins 3 (signal) and 12 (ground) of connector J6 on the driver board. Press the "↓" key: the measured value should be approximately 4.65 Vdc.

(4) Check that there are no visible scorch marks, and that the travel of the moving parts is not obstructed.

6.10. THE DISPLAYED ELEVATION IS INCORRECT

The machine displays this error if:

- the reset procedure detects an incorrect reference;
- the encoder signal is incorrect due to a bad reading or noise.



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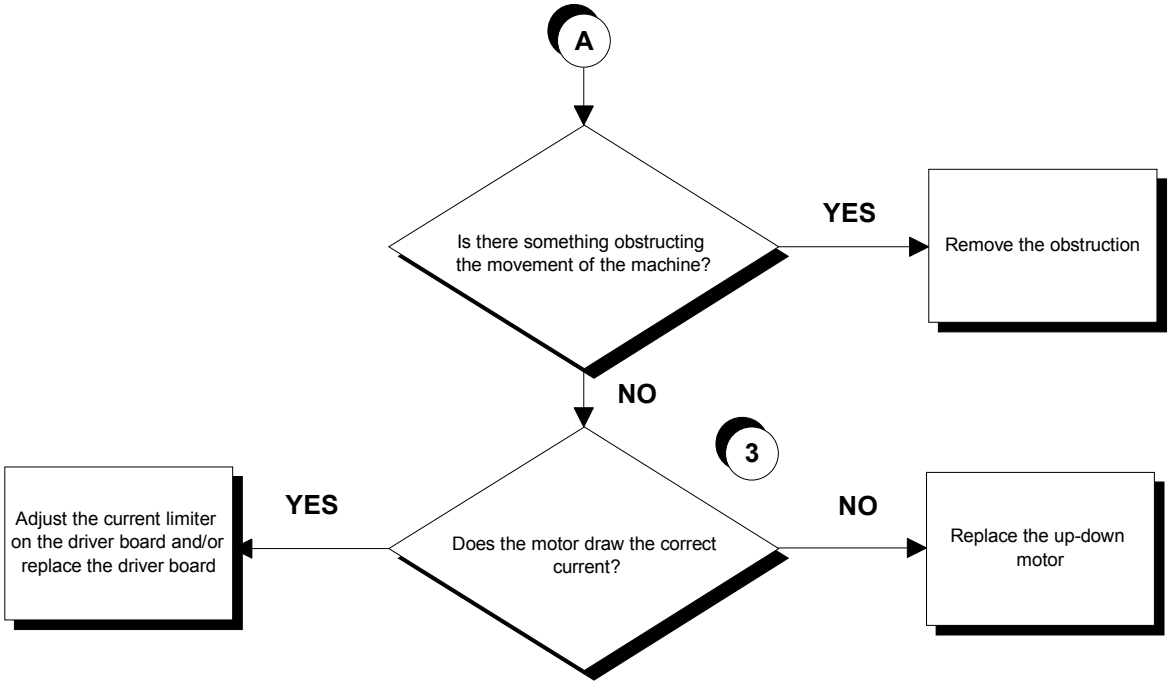


Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

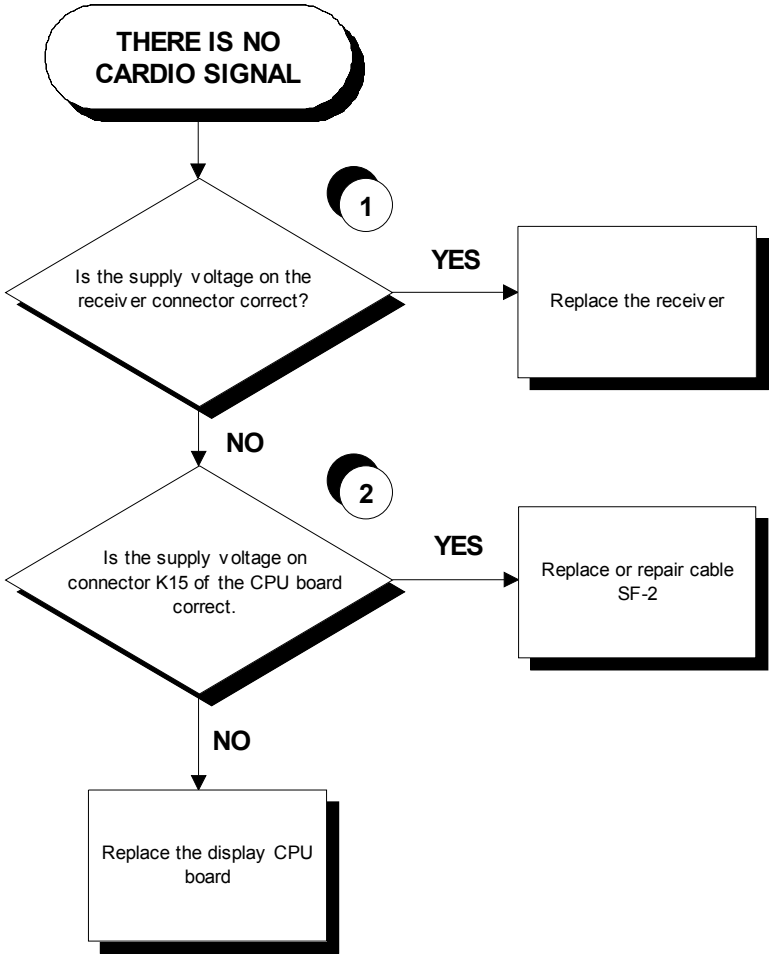
(1) To measure the encoder signal input to the driver board, place the tester probes between pins 5 (signal) and 6 (ground) of connector J1. To measure the encoder signal output by the driver board, place the tester probes between pins 9 (signal) and 11 (ground) of connector J6.

(2) To measure the encoder signal output by the driver board, place the tester probes between pins 9 (signal) and 11 (ground) of connector J6. To measure the encoder signal input to the CPU board, place the tester probes between pins 9 (signal) and 11 (ground) of connector K4.

(3) Place the tester probes in series with the motor cable. Press the "↑" or "↓" key: the steady-state measured value should be less than 4÷5 A.

6.11. THERE IS NO HEART RATE SIGNAL

The machine displays this error if the receiver is not working or if it is not supplied by the CPU board.



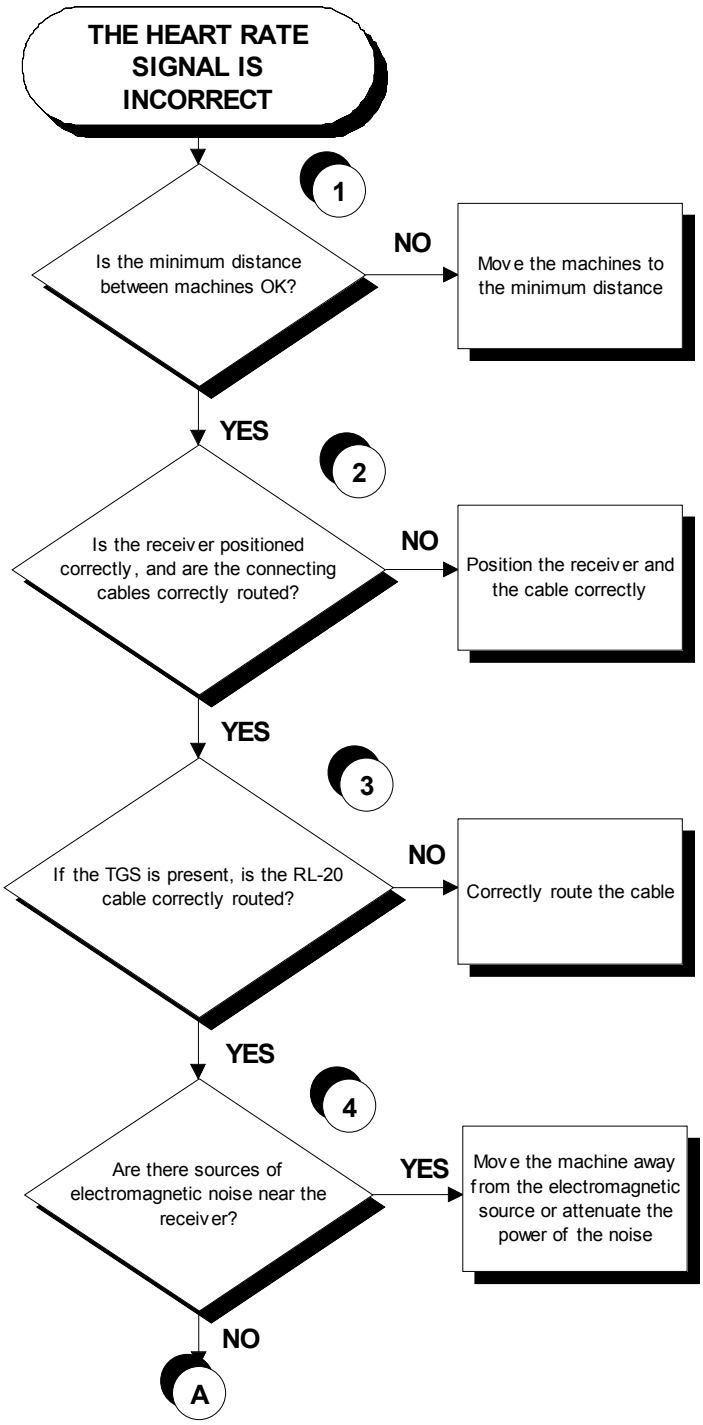
Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) Place the tester probes between pins 1 (signal) and 3 (ground) (the red and black wires) of the 4-pin receiver connector: the measured value should be +5Vdc.

(2) Place the tester probes between pins 1 (signal) and 3 (ground) (the red and black wires) of connector K15 on the CPU board of the display: the measured value should be +5Vdc.

6.12. THE HEART RATE SIGNAL IS INCORRECT

The machine displays this error if the receiver is disturbed by electromagnetic noise.



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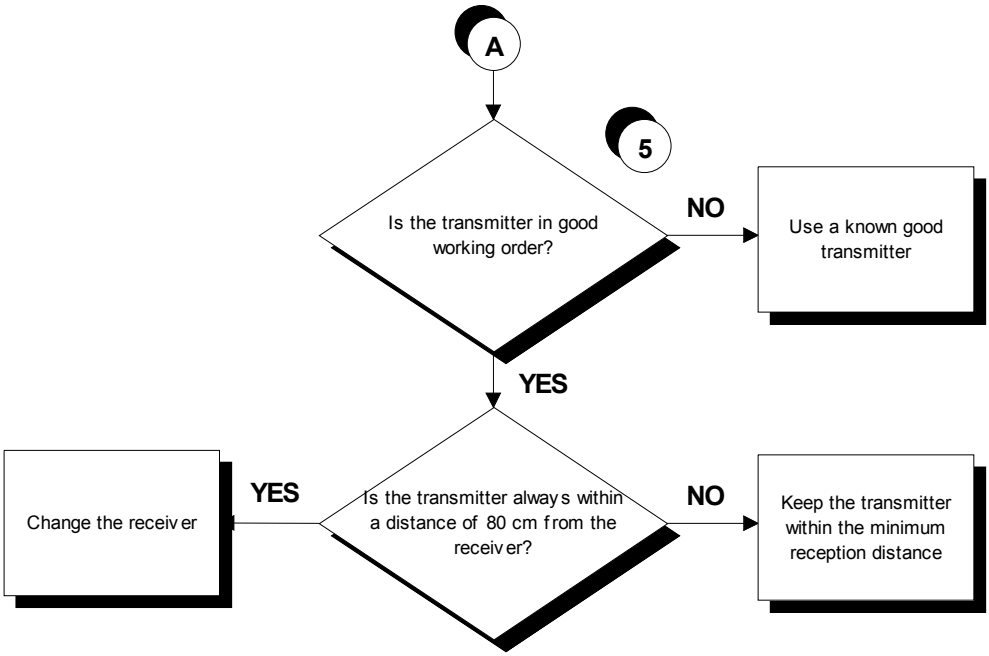


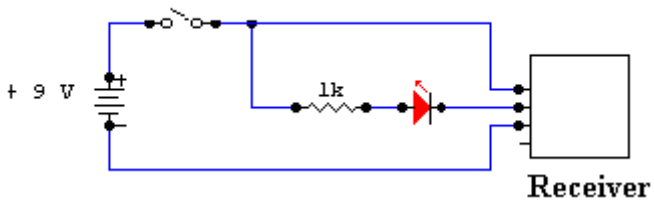
Follow the procedure step by step to correctly diagnose the problem. Take particular care with the checks highlighted by circled numbers, which are described in detail below:

(1) See paragraph 5.1. "Specifications and requirements".

(2) See paragraph 11.1. "Technical notes on cardio receivers".

(3) See paragraph 11.1. "Technical notes on cardio receivers".

(4) To check for electromagnetic noise near the machine, use a frequency signal monitor constructed as shown in the schematic below:



The circuit lights the LED for every heart beat and/or disturbance that is received: in this way it possible to determine whether there is any interference, and identify its sources.

(5) Check the battery power level, using a tester if possible. Otherwise use a receiver or another "reference" machine to check operation up to a distance of about 80 cm from the receiver.

☞ **ATTENTION: Consult paragraph 11.1. "Technical notes on cardio receivers".**

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7. DISASSEMBLY OF COMPONENTS

7.1. DISASSEMBLING THE DISPLAY

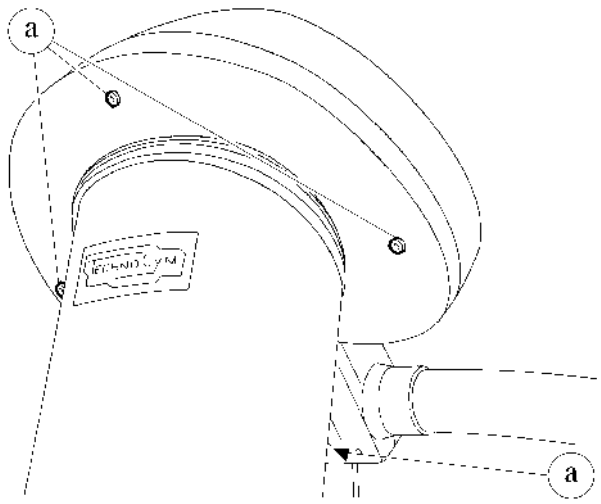

Figure 7.1-1

1. Turn off the machine and unplug the mains lead from the wall outlet.

2. Back off the 4 screws **a** using a phillips screwdriver.
3. Unplug the cable connector.
4. Remove the DISPLAY.

To reassemble the DISPLAY, carry out the above steps in reverse order.

7.2. DISASSEMBLING THE EPROM

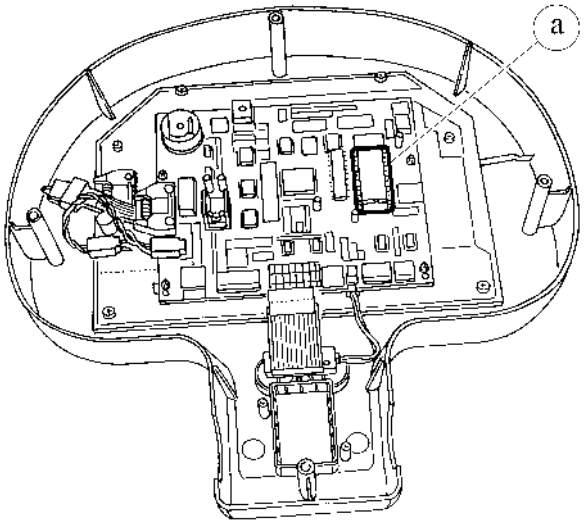

Figure 7.2-1

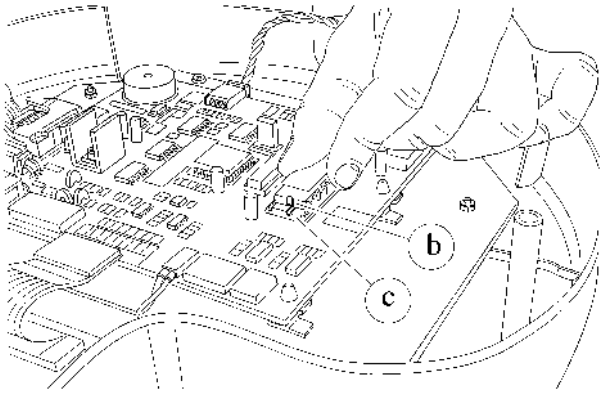

Figure 7.2-2

Carry out the procedure described in paragraph 7.1. “Disassembling the display”.

With the display placed on a work bench:

1. Remove EPROM **a** from its socket, using an IC extractor tool.

To reassemble the EPROM:

1. Insert the EPROM pins into the socket starting from the top, so that the lower holes of the socket remain free.
2. Make that the reference index **b** on the EPROM coincides with the reference notch **c** on its socket.
3. Be careful to position the EPROM pins directly above the holes on the socket.
4. Push the pins into the socket.

The EPROM may be irreversibly damaged if its reference index is not correctly matched up with the notch on the socket, or if its pins are bent.

7.3. DISASSEMBLING THE DISPLAY BOARDS

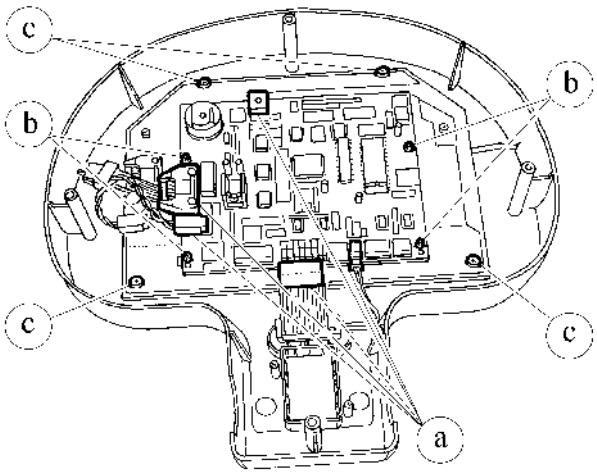

Figure 7.3-1

Carry out the procedure described in paragraph 7.1. “Disassembling the display”.

With the display placed on a work bench:

1. Unplug connectors **a**.
2. Remove the 4 fasteners **b**.
3. Remove the CPU BOARD.
4. Back off the 4 screws **c** using a medium phillips screwdriver.
5. Remove the LED BOARD.

To reassemble the circuit boards, carry out the above steps in reverse order.

7.4. DISASSEMBLING THE KEYBOARD

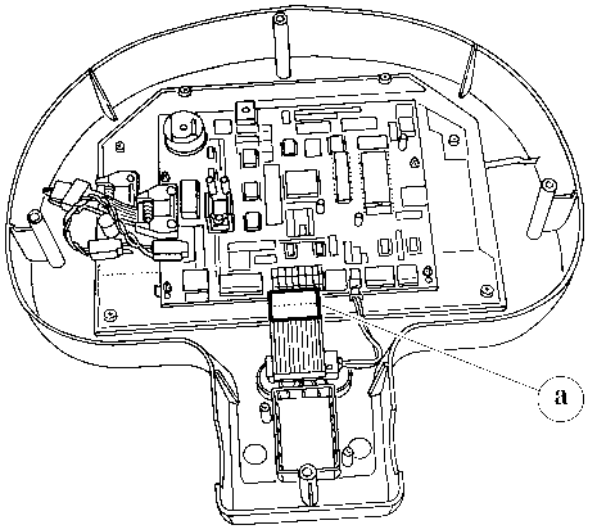

Figure 7.4-1

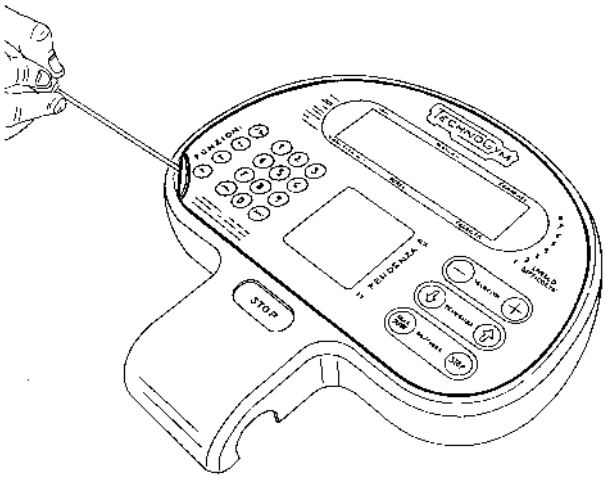

Figure 7.4-2

Carry out the procedure described in paragraph 7.1. “Disassembling the display”.

With the display placed on a work bench:

1. Unplug the KEYBOARD connector **a**.

2. Using a pointed tool, lift up and detach a corner of the KEYBOARD.

To reassemble the new KEYBOARD:

1. Remove backing film from the adhesive side.
2. Apply the adhesive part, starting from the top and working toward the bottom, being careful not to bend the KEYBOARD.
3. Insert the connector in the special slot on the display and connect it to the CPU board.
4. Remove the protective film.

When reassembling the KEYBOARD, make sure that none of the keys are bent or remain pushed in.

The KEYBOARD assembly procedure can only be performed once, because disassembly damages the tracks and keys.

7.5. DISASSEMBLING THE CARDIO RECEIVER

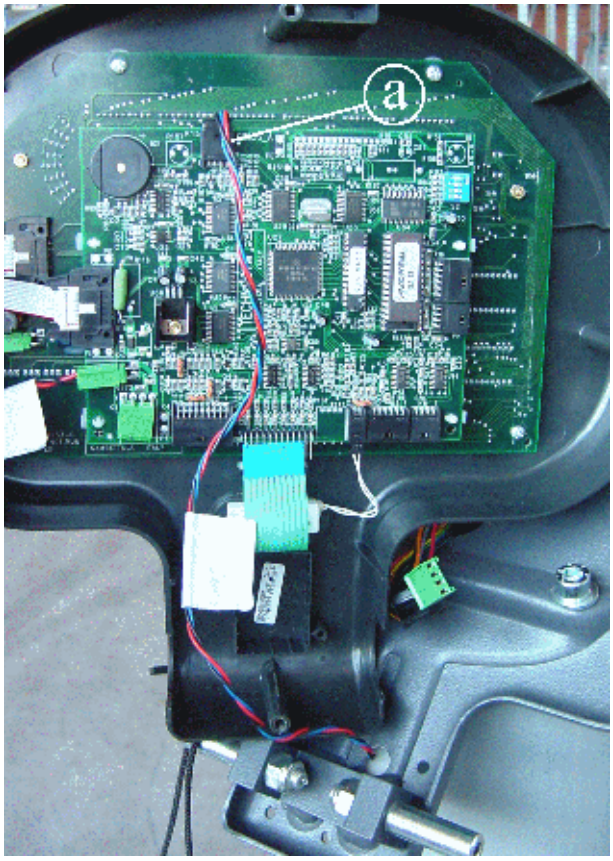

Figure 7.5-1

Carry out the procedure described in paragraph 7.1. “Disassembling the display”.

With the display placed on a work bench:

1. Unplug connector **a** of cable SF-2 from the CPU board.

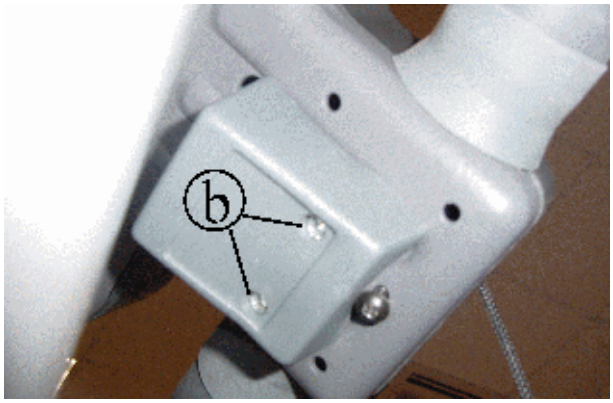

Figure 7.5-2

2. Back off the two screws **b** using a 3-mm hex T wrench.
3. Remove the RECEIVER.

To reassemble the RECEIVER, carry out the above steps in reverse order, placing it between the 2 foam pads.

7.6. DISASSEMBLING THE SAFETY SWITCH

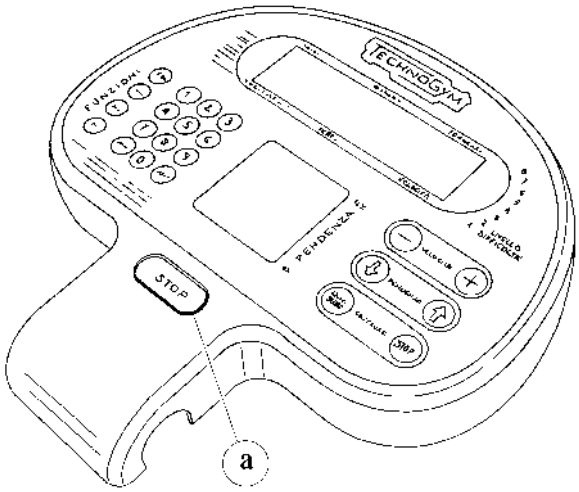

Figure 7.6-1

Carry out the procedure described in paragraph 7.1. “Disassembling the display”.

With the display placed on a work bench:

1. Lift up the sticker **a** situated underneath the “Safety switch”;
2. Using a medium phillips screwdriver, back off the 2 screws under the sticker.

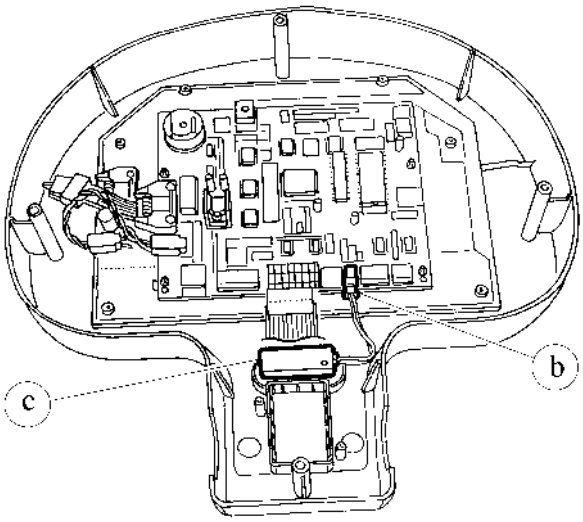

Figure 7.6-2

3. Unplug connector **b** of cable RL-17.
4. Remove the SAFETY SWITCH **c**.

To reassemble the SAFETY SWITCH, carry out the above steps in reverse order.

7.7. DISASSEMBLING THE GAS DAMPER

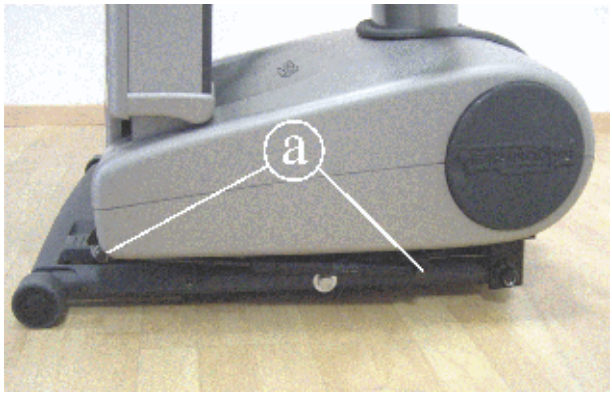

Figure 7.7-1

1. Close the machine so that the gas dampers are entirely discharged.
2. Using a 4-mm hex wrench, back off the two screws securing the right gas damper to the machine frame.
3. Remove the gas damper.

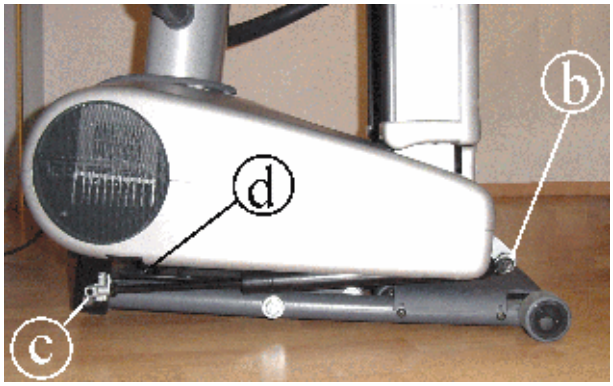

Figure 7.7-2

4. Back off the screw **b**, using a 4-mm hex wrench.
5. Remove the snap ring **c** which fixes the damper to the machine frame.
6. Disconnect the steel cable **d** and remove the gas damper.

When reassembling, lock down screws a and b using a torque wrench with a setting of 14.7 Nm / 10.8ftlbs.

7.8. DISASSEMBLING THE MOTOR GUARD

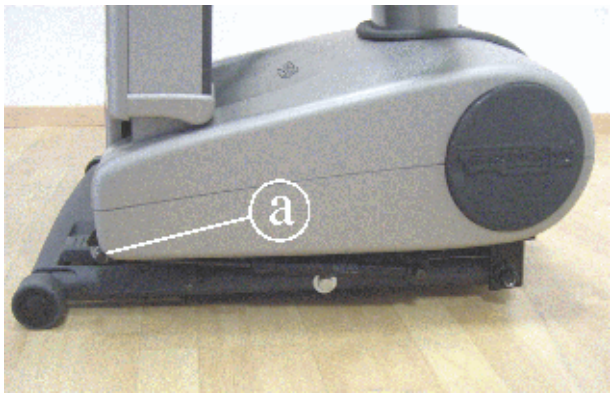

Figure 7.8-1

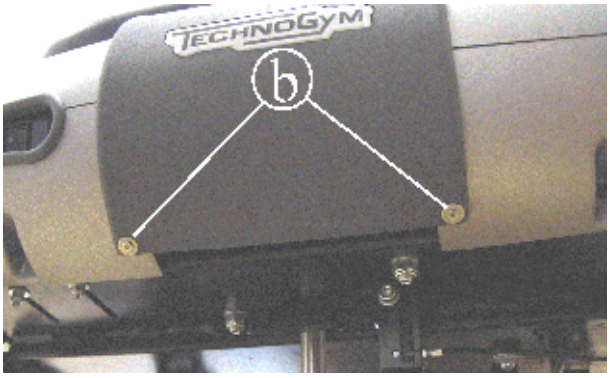

Figure 7.8-2

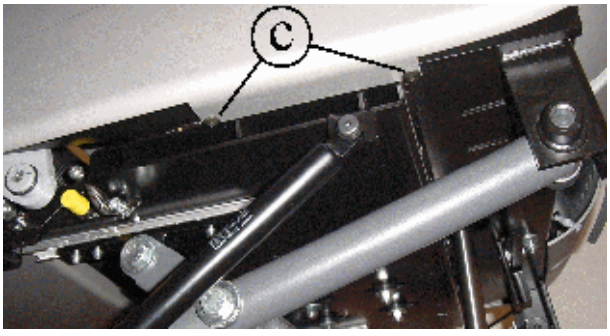

Figure 7.8-3

1. Close the machine so that the gas dampers are fully discharged.
2. Back off the screws **a** on either side, using a 4-mm hex wrench.
3. Rest the gas damper on the ground.

4. Open the machine to the working position.

Take care while lowering the running deck, as this action is no longer assisted by the gas dampers.

5. Raise the machine to an incline of approximately 5%.
6. Back off the two screws **b** using a small Phillips screwdriver.
7. Lift up the rubber guard, and fix it to the column with some adhesive tape.

8. On each side of the machine, back off the two screws **c** using a 4-mm hex wrench.

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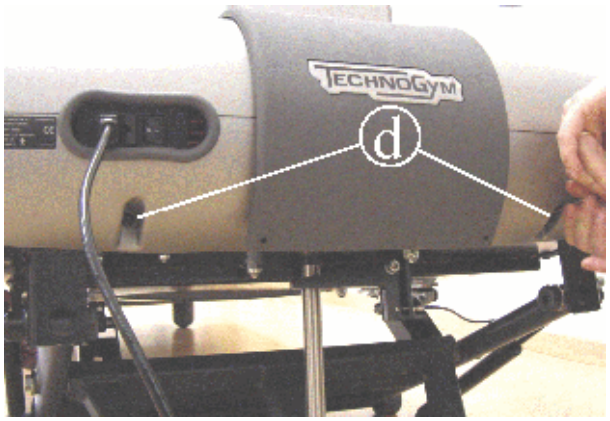

Figure 7.8-4

9. Back off the two screws **d** using a 4-mm hex wrench.

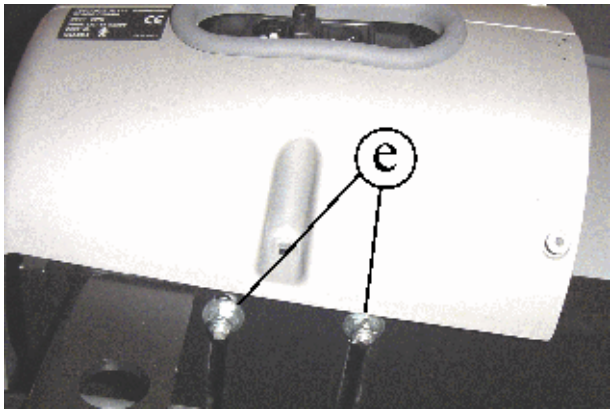

Figure 7.8-5

10. Use a 10-mm hex wrench to back off the two nuts **e** securing the power inlet block and push it toward the inside of the machine.
11. Remove the MOTOR GUARD by rotating it toward the right and pulling it out from the top.

To reassemble the MOTOR GUARD, carry out the above steps in reverse order.

7.9. DISASSEMBLING THE TREAD-BELT MOTOR

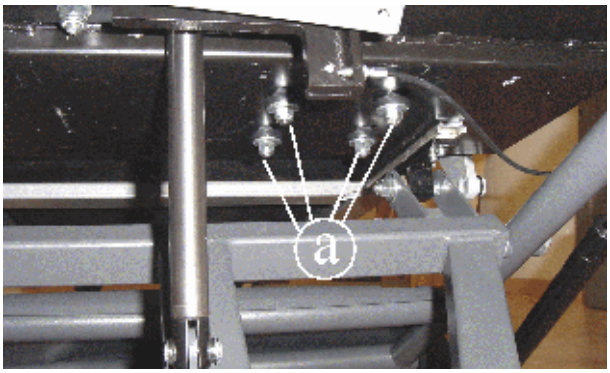

Figure 7.9-1

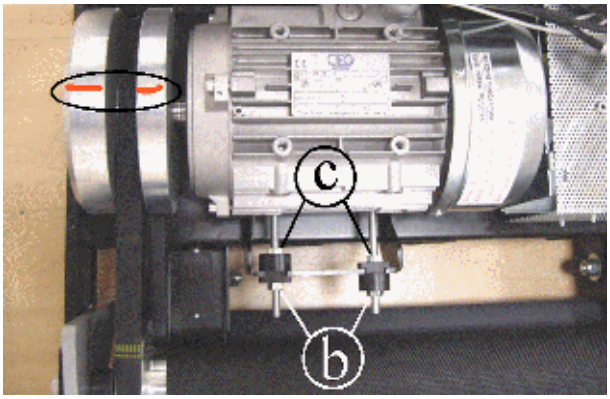

Figure 7.9-2

Figure 7.9-3

Carry out the procedure described in paragraph 7.7. “Disassembling the motor guard”.

1. Raise the machine to an incline of approximately 5%.
2. Turn off the machine and unplug the mains lead from the wall outlet.
3. Unscrew the 4 nuts **a** which fix the belt motor to the machine frame using a 13-mm wrench.
4. Unscrew the 2 outer nuts **b** and the 2 inner nuts **c** using a 13-mm wrench.
5. Move the TREAD BELT MOTOR toward the driving roller.
6. Unscrew the screw **d** using a small Phillips screwdriver.
7. Remove the cover and disconnect the cables coming from the belt motor.
8. Lift up the motor.
9. Disengage the motor belt.
10. Remove the BELT MOTOR.

To reassemble the BELT MOTOR, carry out the above steps in reverse order.

When reassembling, lock down screws a and b using a torque wrench with a setting of 13 Nm / 9.6ftlbs.

When reassembling the TREAD BELT MOTOR, be careful to fit the plastic components which assure its isolation from the floor.

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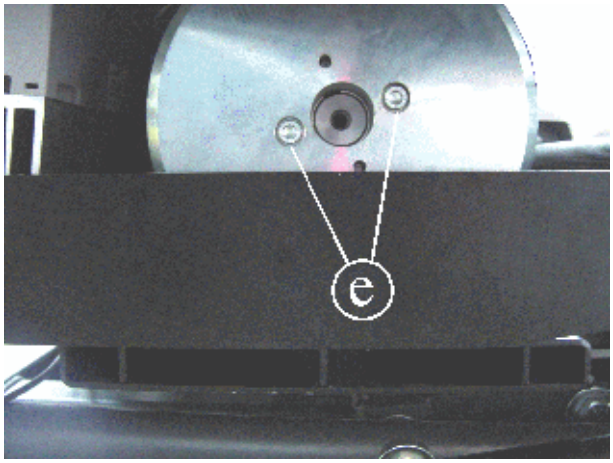

Figure 7.9-4

If it is necessary to disassemble the outer flywheel, use a pen to mark the top part of both flywheels as shown in the figure.

11. Back off the two screws **e** using a 4-mm hex wrench.
12. Remove the flywheel toward the outside, pulling it away from the two pins that connect it to the motor pulley.

To reassemble the flywheel the right way round, use the markings made previously.

When reassembling, lock down screws a and b using a torque wrench with a setting of 10.3 Nm / 7.6 ftlbs.

7.10. DISASSEMBLING THE FOOTREST GUIDE

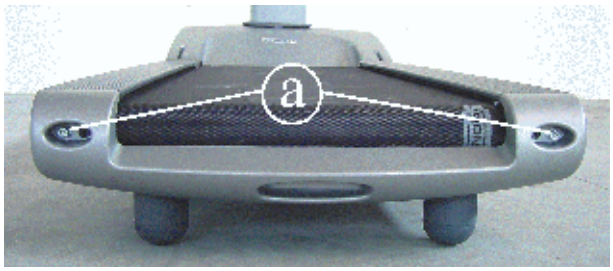

Figure 7.10-1

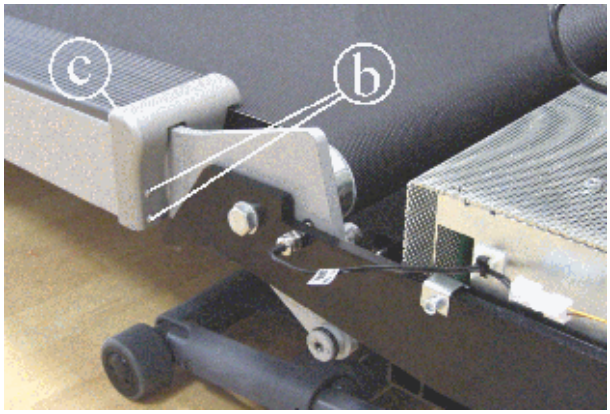

Figure 7.10-2

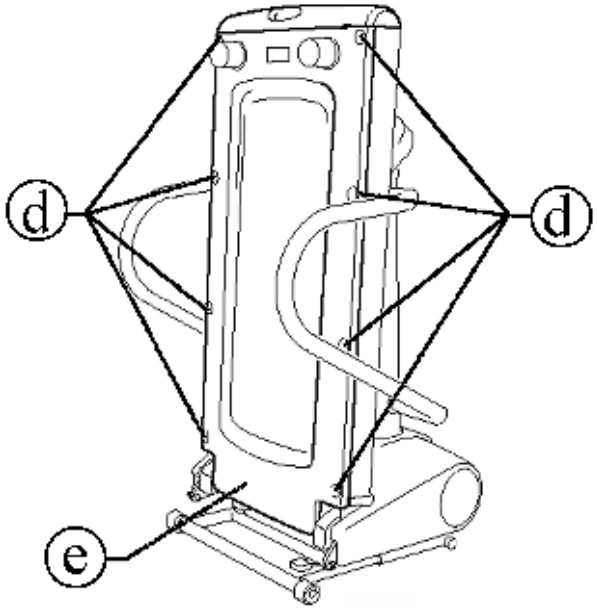

Figure 7.10-3

Carry out the procedure described in paragraph 7.8. “Disassembling the motor guard”.

1. Back off the screws **a** using a 6-mm hex T wrench and remove the rear covering.

On each side of the machine:

2. Back off the 2 screws **b** using 2.5-mm hex T wrench and remove the covering **c**.

3. Close the machine, back off the 8 screws **d** using a medium Phillips screwdriver, and remove the guard **e**.

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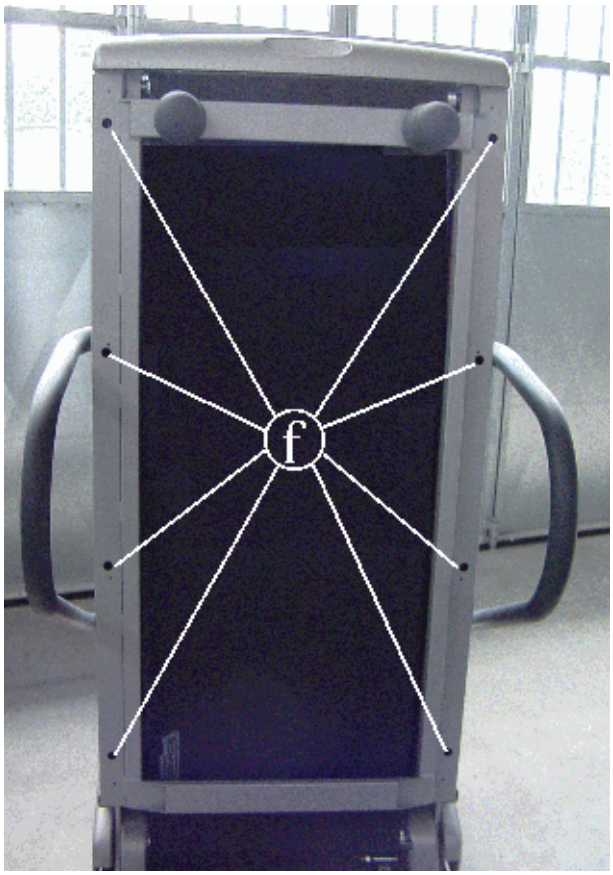

Figure 7.10-4

4. Back off the 8 screws **f** which can be accessed with a 10-mm socket wrench.
5. Reposition the tread belt on the ground.

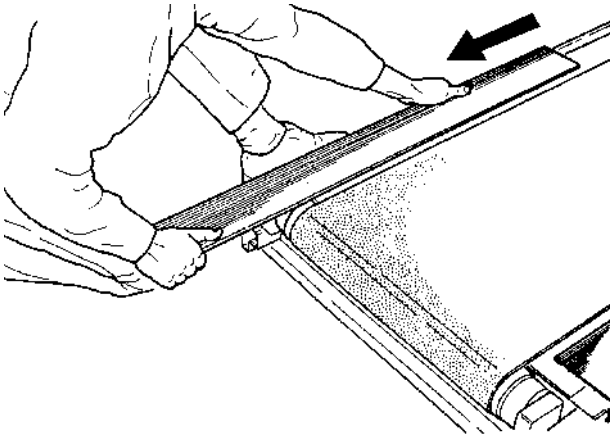

Figure 7.10-5

6. Remove the FOOTRESTS GUIDE from the rear side.

To reassemble the FOOTRESTS, carry out the above steps in reverse order.

7.11. DISASSEMBLING THE REAR ROLLER

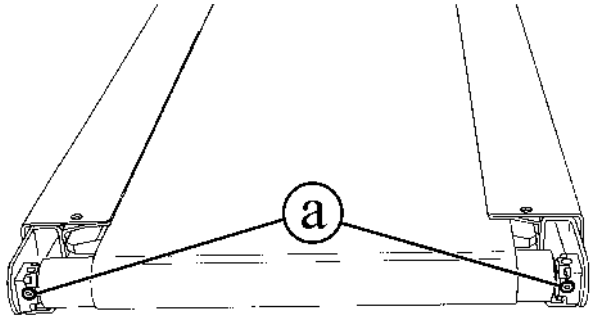

Figure 7.11-1

Carry out the procedure described in paragraph 7.8. “Disassembling the motor guard” e .7.10. “Disassembling the footrest guide”.

To facilitate the subsequent tightening of the tread-belt, move the seam to the underside of the machine and measure out a distance of 1 m on the belt, marking its ends with a white felt tip pen.

1. Slacken the belt tension, backing off the 2 screws **d** using a 6-mm hex T wrench.
2. Pull the REAR ROLLER out of its supports.
3. Remove the REAR ROLLER from the side.

To reassemble the REAR ROLLER, carry out the above steps in reverse order.

After completing the procedure, adjust the tension and centering of the tread-belt as described in paragraphs 8.2. and 8.3. .

7.12. DISASSEMBLING THE MOTOR ROLLER AND DRIVE-BELT

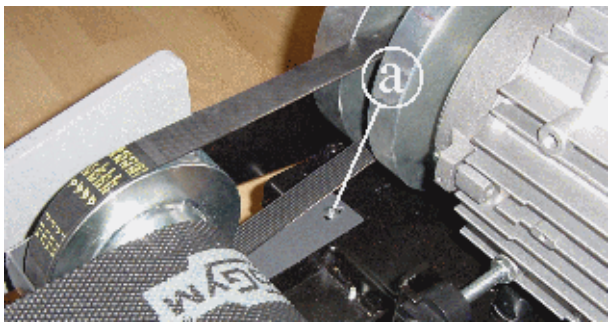

Figure 7.12-1

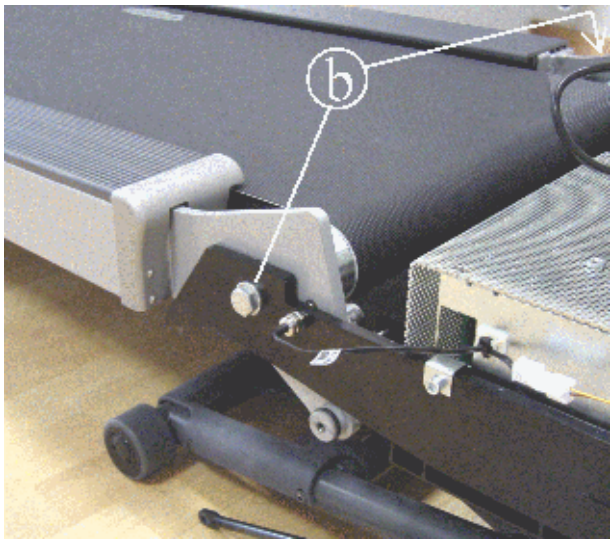

Figure 7.12-2

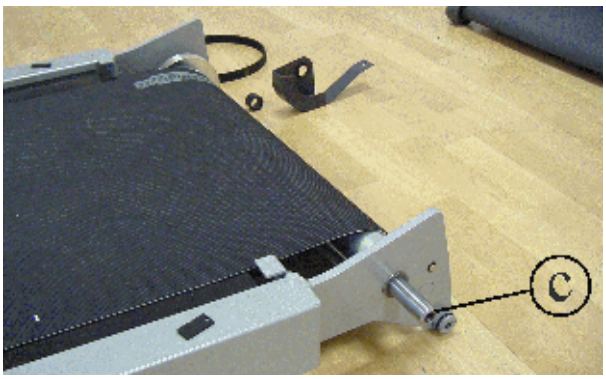

Figure 7.12-3

Carry out the procedure described in paragraph 7.8. "Disassembling the motor guard" 7.9. "Disassembling the tread-belt motor", up until the removal of the belt.

1. Back off the screw **a** which fixes the belt guard to the frame, using a small Phillips screwdriver.
2. Move the belt motor toward the driving roller.
3. Disengage the motor belt from the tread-belt motor pulley.

To facilitate the subsequent tightening of the tread-belt, move the seam to the underside of the machine and measure out a distance of 1 m on the belt, marking its ends with a white felt tip pen.

4. Use a 19-mm wrench to back off the screws **b** securing the motor roller to the machine frame.
5. Separate the rear machine frame, which comprises the running deck, from the front section which comprises the column.

When reassembling, lock down screws b using a torque wrench with a setting of 86 Nm / 63.4 ftlbs.

6. Remove pin **c** from the roller.
7. Remove the DRIVE-BELT from the tread-belt motor pulley.
8. Remove the MOTOR ROLLER from the left side.

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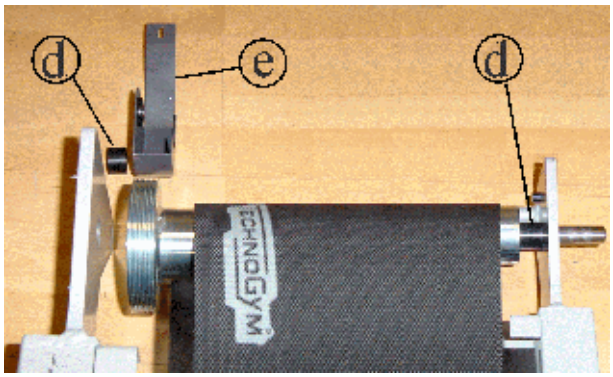

Figure 7.12-4

To reassemble the MOTOR ROLLER and the DRIVE-BELT, carry out the above steps in reverse order, remembering to first insert the belt on the roller pulley, followed by guard **e** and finally the two bushings **d**.

After completing this procedure, adjust the tension and centering of the tread-belt as described in paragraphs 8.2. and 8.3. and adjust the tension and alignment of the DRIVE-BELT as described in paragraph 8.4.

7.13. DISASSEMBLING THE TREAD-BELT AND RUNNING TRACK

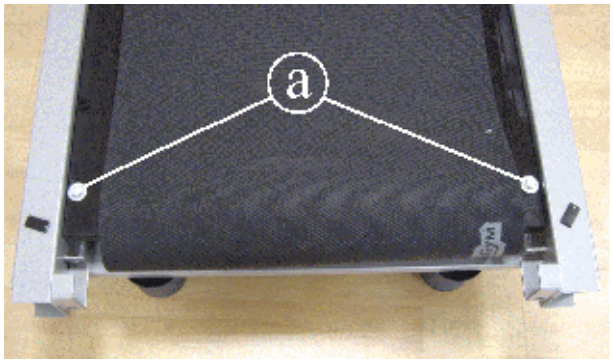

Figure 7.13-1

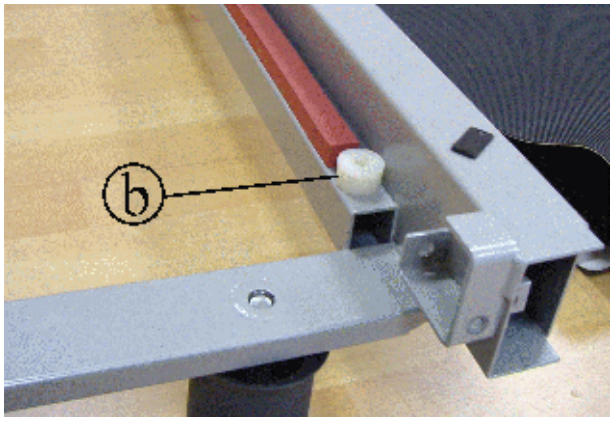

Figure 7.13-2

Carry out the procedures described in paragraphs 7.8. “Disassembling the motor guard” 7.11. “Disassembling the rear roller” 7.12. “Disassembling the motor roller and drive-belt”.

1. Back off the 2 rear screws **a** using a 13-mm wrench.
2. Remove the RUNNING TRACK and TREAD-BELT group from the back.
3. Remove the TREAD-BELT from the RUNNING TRACK.

To reassemble the TREAD-BELT and the RUNNING TRACK, carry out the above steps in reverse order.

Lubricate the RUNNING TRACK before reassembling it.

When reassembling the TREAD-BELT, make sure that:

- **there are the two bushing b;**
- **the TREAD-BELT is assembled in the direction indicated by the direction arrow on the inner side, if one is present;**
- **the TREAD-BELT is correctly centered on the RUNNING TRACK;**
- **the TREAD-BELT is not pinched by the RUNNING TRACK.**

After completing the procedure, adjust the tension and centering of the belt as described in paragraphs 8.2. and 8.3. and adjust the tension and alignment of the motor drive-belt as described in paragraph 8.4. .

7.14. DISASSEMBLING THE SHOCK ABSORBERS

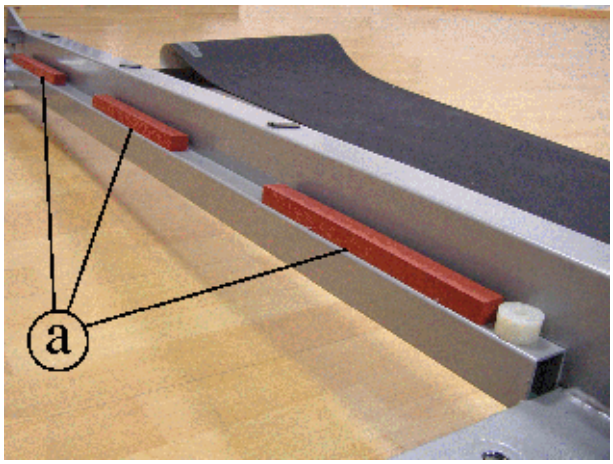

Figure 7.14-1

Carry out the procedures described in paragraph 7.13. “Disassembling the tread-belt and running track”.

1. On each side of the machine, remove the SHOCK ABSORBERS **a** from the top, detaching them from the adhesive film.

To reassemble the SHOCK ABSORBERS, carry out the above steps in reverse order.

7.15. DISASSEMBLING THE ELECTRONIC CIRCUIT BOARDS

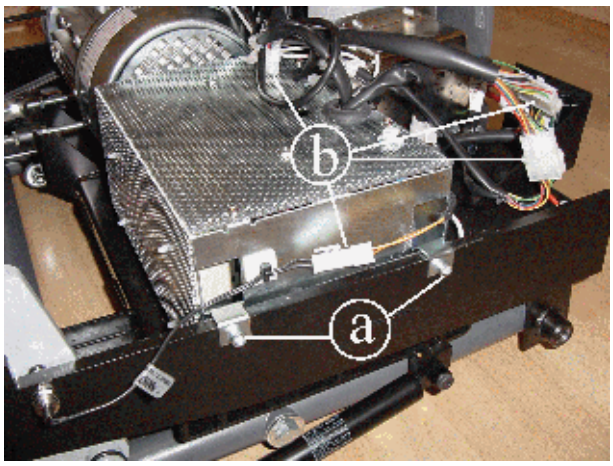

Figure 7.15-1

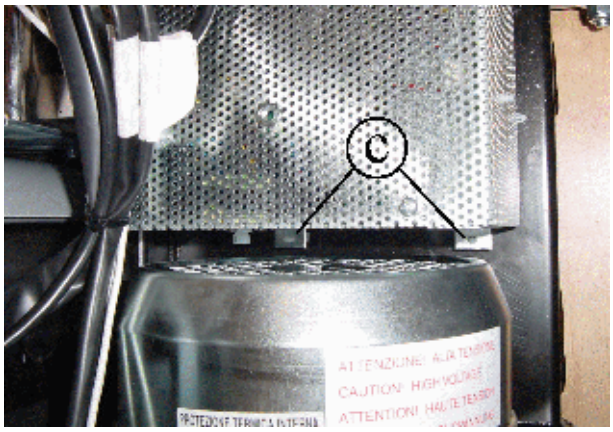

Figure 7.15-2

Carry out the procedures described in paragraph 7.8. “Disassembling the motor guard”.

1. Back off the 2 screws **a** using a 5-mm hex T wrench.
2. Cut the cable locking strips.
3. Unplug connectors **b**, the cables connected to the filter and the ones from the inverter.

4. Remove the 4 fasteners **c**.
5. Remove the electrical box.

Place the box on a work bench.

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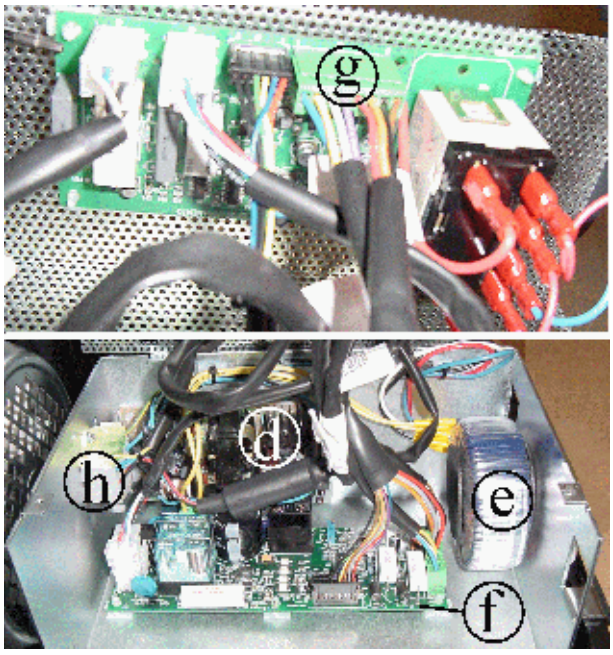

Figure 7.15-3

1. Back off the 4 cover fixing screws using a medium phillips screwdriver.
2. Remove the cover, taking care not to damage the connected wires.

To disassemble the POWER SUPPLY **d**:

1. Unplug the connected cables.
2. Release the 4 clip fasteners.
3. Remove the POWER SUPPLY.

To disassemble the TRANSFORMER **e**:

1. Disconnect the secondary cables from the driver board.
2. Disconnect the primary cables from the connector **h**.
3. Back off the fixing screw using a 10-mm wrench.
4. Remove the TRANSFORMER.

To disassemble the DRIVER BOARD **f**:

1. Unplug the connected cables.
2. Release the 6 clip fasteners.
3. Remove the DRIVER BOARD.

After replacing the DRIVER BOARD, calibrate the speed as described in paragraph 8.6. .

To disassemble the POWER ISOLATING BOARD **g**, fixed to the cover:

4. Unplug the connected cables.
5. Release the 4 clip fasteners.
6. Remove the POWER ISOLATING BOARD.

To reassemble the ELECTRONIC CIRCUIT BOARDS, carry out the above steps in reverse order.

7.16. DISASSEMBLING THE INVERTER

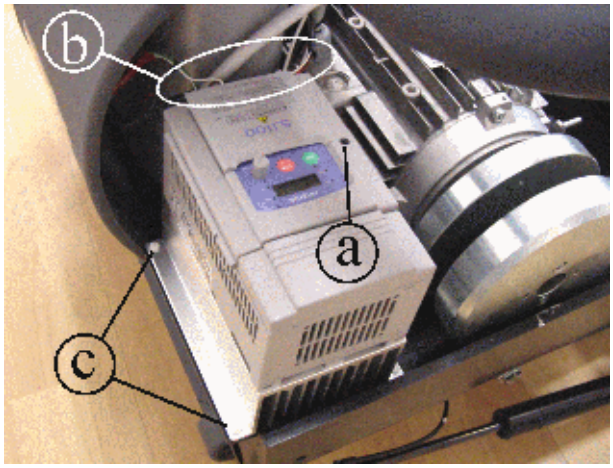

Figure 7.16-1

1. Carry out the procedures described in paragraph 7.8. “Disassembling the motor guard”.

2. Open the INVERTER covers, backing off screw **a** with a small phillips screwdriver.

3. Disconnect the electrical cables **b** using a small flat-blade screwdriver and a medium phillips screwdriver.
4. Disconnect the inverter ground cable using a medium phillips screwdriver.
5. Back off the 4 fixing screws **c** (the other two are on the motor side), using a 7-mm socket wrench.
6. Remove the INVERTER.

To reassemble the INVERTER, carry out the above steps in reverse order.

When reassembling the INVERTER, be sure to use the plastic screws and washers which ensure its isolation from ground.

When reassembling the INVERTER, do not overtighten the plastic screws to avoid damaging the thread.

After completing the procedure, calibrate the speed as described in paragraph 8.6. .

7.17. DISASSEMBLING THE COLUMN AND RUBBER GUARD

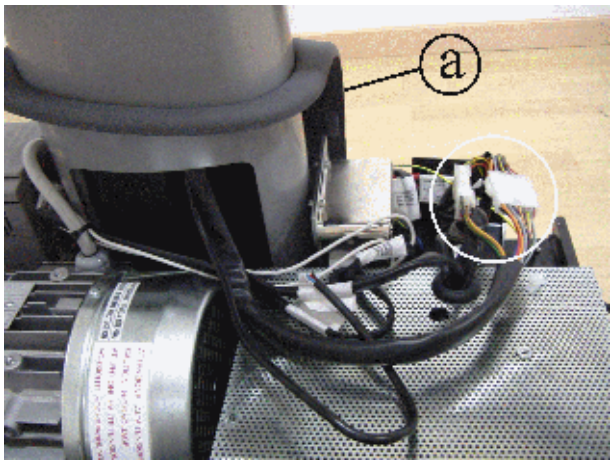

Figure 7.17-1

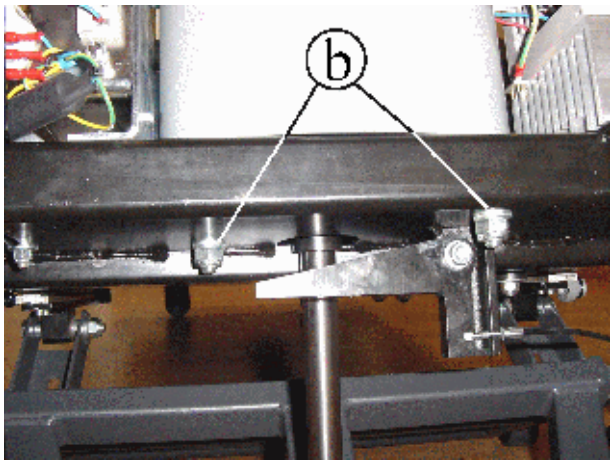

Figure 7.17-2

1. Carry out the procedure described in paragraph 7.8. “Disassembling the motor guard”.
2. Raise the machine to its maximum incline position.
3. Unplug the connectors indicated in the figure.
4. Back off the 2 nuts **b** using a 17-mm wrench.
5. Remove the COLUMN by lifting it upward.
6. Remove the RUBBER GUARD **a**.

Be careful not to damage the finish of the column.

To reassemble the COLUMN, carry out the above steps in reverse order.

Before resting the COLUMN on the frame, remember to insert the rubber guard.

7.18. DISASSEMBLING THE UP-DOWN MOTOR

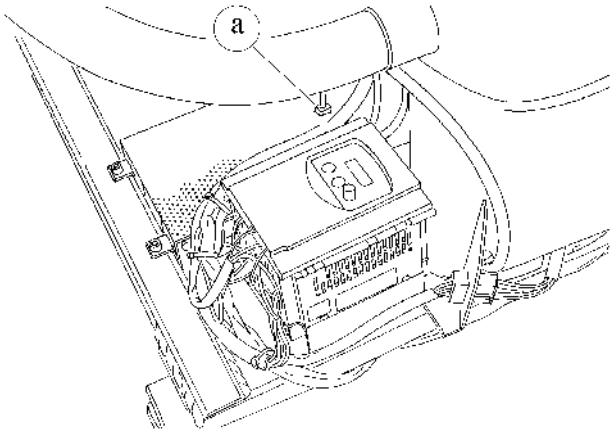

Figure 7.18-1

1. Carry out the procedure described in paragraph 7.17. “Disassembling the column and rubber guard”.

2. Disconnect the motor supply cable **a** from the electrical box.
3. Detach its locking strip.

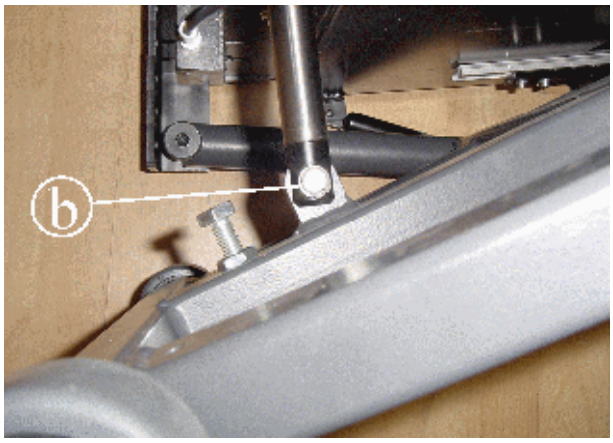

Figure 7.18-2

Overturn the machine on one side:

4. Remove the snap ring **b** using the special pliers.
5. Disconnect the UP-DOWN MOTOR rod from the up-down frame.

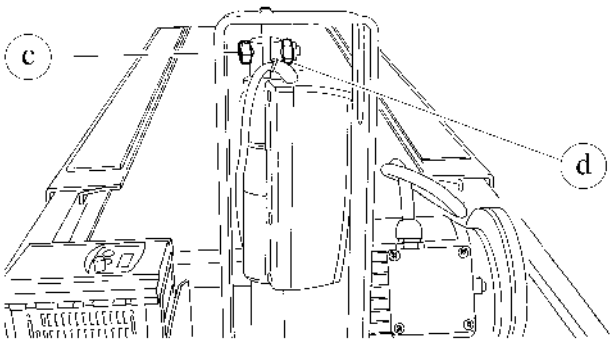

Figure 7.18-3

6. Back off the screw **c** and the nut **d** using 2 17-mm wrenches.
7. Remove the UP-DOWN MOTOR.

To reassemble the UP-DOWN MOTOR, carry out the above steps in reverse order.

During reassembly, be careful not to overtighten the screw c and the nut d, in order to allow the UP-DOWN MOTOR a certain amount of play.

7.19. DISASSEMBLING THE UP-DOWN FRAME

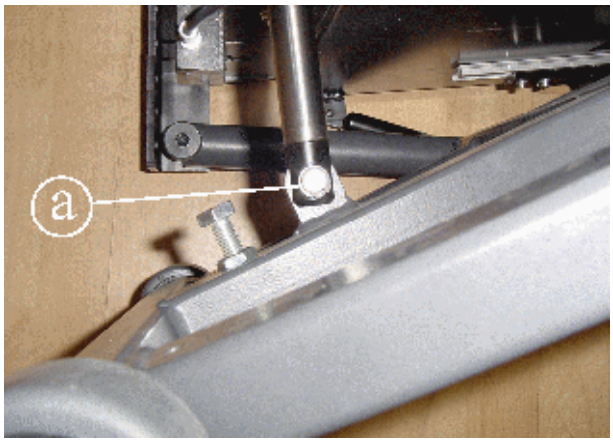

Figure 7.19-1

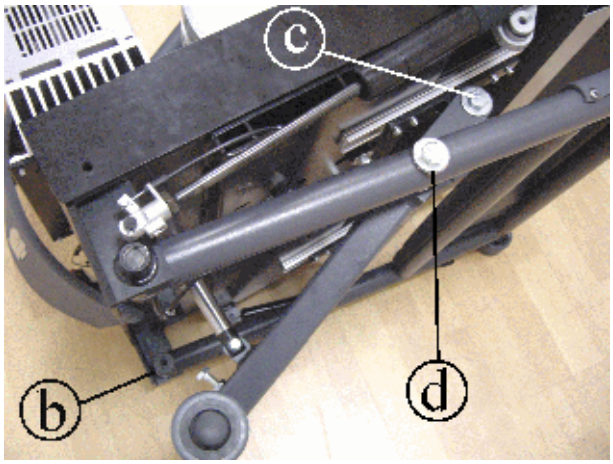

Figure 7.19-2

1. Raise the machine to its maximum incline position.

2. Overturn the machine on its right side.
3. Remove the snap ring **a** using the special pliers.
4. Disconnect the up-down motor rod from the UP-DOWN FRAME.

Working on both sides:

5. Back off the nut **b**, using 10-mm hex T wrench.
6. Back off the nut **c**, using two 17-mm wrenches.

7. Remove the UP-DOWN FRAME.

8. The part with the front wheels can be separated from the part with the rear wheels by backing off the screws **d**.

When reassembling, lock down screws c using a torque wrench with a setting of 50 Nm / 36.8 ftlbs.

To reassemble the UP-DOWN FRAME, carry out the above steps in reverse order.

7.20. DISASSEMBLING THE HANDLEBARS

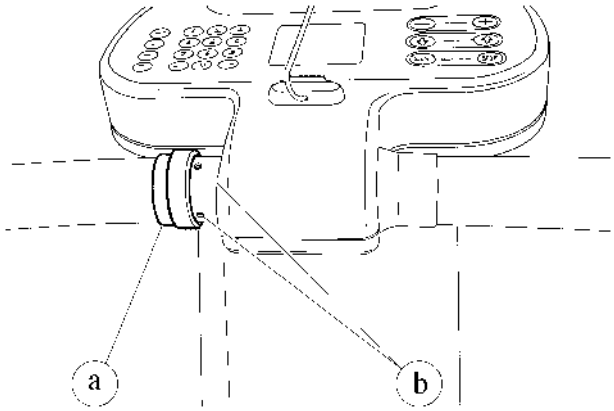

Figure 7.20-1

1. Turn off the machine and unplug the mains lead from the wall outlet.

For each handlebar:

2. Shift the rubber bushings **a**.
3. Back off the 2 dowels **b** using a 5-mm hex T wrench.

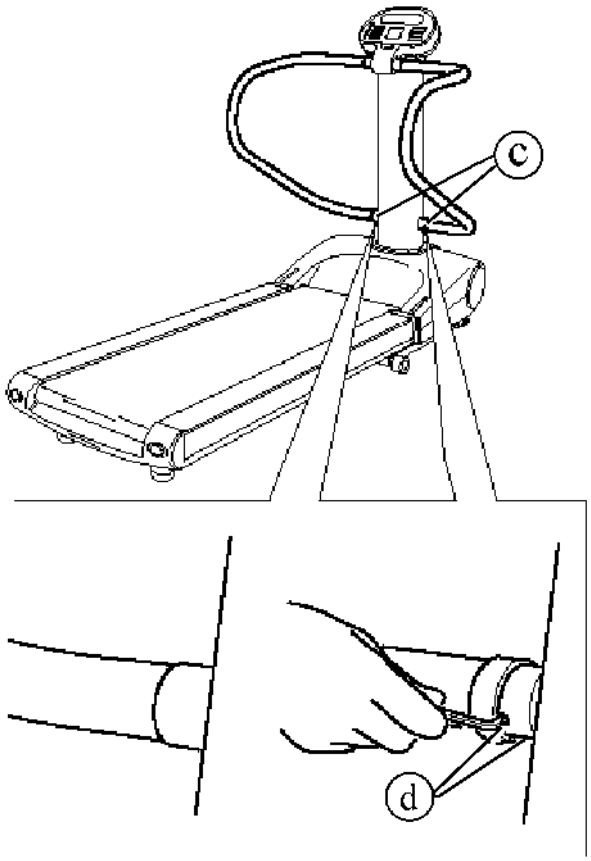

Figure 7.20-1

4. Shift the rubber bushings **c**.
5. Back off the 2 dowels **d** using a 3-mm hex T wrench.
6. Remove the HANDLEBAR

To reassemble the HANDLEBARS, carry out the above steps in reverse order.

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8. ADJUSTMENTS

8.1. TENSIONING A NEW TREAD-BELT

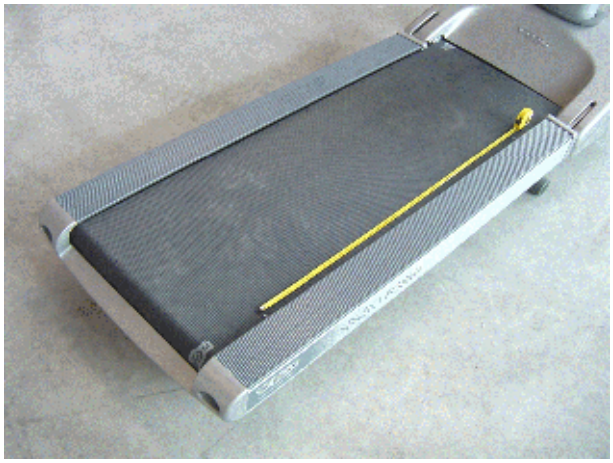

Figure 8.1-1

Figure 8.1-2

1. After assembling the new tread-belt, turn it until the seam is underneath, and tighten the tread-belt until it is just slightly taut.
2. Place a tape measure along the right edge of the tread-belt and, using a pen, make two reference marks spaced exactly **1 meter** apart.

3. Lock down the right screw **a** until the distance between the reference marks increases by **8 mm**.
4. Lock down the left screw until the rear roller is aligned with the crosspiece.

After completing this procedure, any further adjustments should be performed using only the left-hand screw.

After completing this procedure, check the centering of the belt as described in paragraph 8.3. .

8.2. TENSIONING A USED TREAD-BELT

Figure 8.2-1

1. Before disassembling the used tread-belt, place a tape measure along the right-hand edge of the tread-belt and, using a pen, make two reference marks spaced exactly **1 meter** apart.
2. After reassembling the used belt, lock down the right belt tensioning screw **a** until the two reference marks on the tread-belt are once again 1 meter apart.

3. Lock down the left screw until the rear roller is aligned with the crosspiece.

This procedure is usually carried out after replacing the motor or rear roller, or in cases where the used tread-belt must be reassembled: it is not possible to perform the procedure as described in paragraph 8.1. because the used tread-belt is not sufficiently elastic.

After completing this procedure, check the centering of the tread-belt as described in paragraph 8.3. .

8.3. CENTERING THE TREAD-BELT

Figure 8.3-1

1. Start the machine at a speed of 10 Km/h.
2. Observe the movement of the tread-belt, correcting any tendency to shift to the right or left exclusively by adjusting the screw **a**. Locking down this screw favors shifting of the belt to the right, and vice versa.
3. Gradually increase the speed to 16 km/h making any small adjustments which may be necessary until the tread-belt is perfectly centered.

8.4. ALIGNING THE TREAD-BELT MOTOR DRIVE-BELT

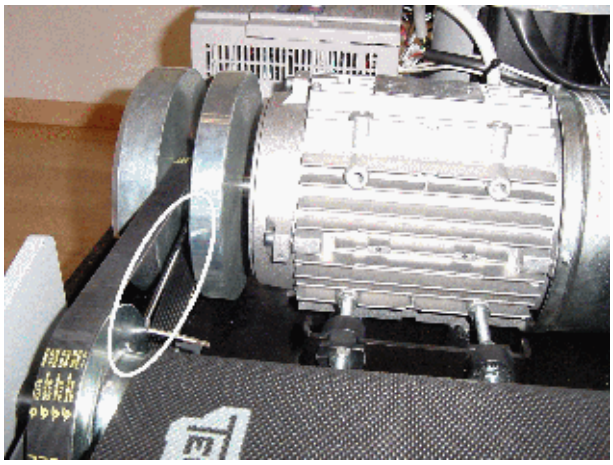

Figure 8.4-1

1. Carry out the procedure described in paragraph 7.8. “Disassembling the motor guard”.
2. Using a 3-mm hex wrench, back off the grub screw on the motor shaft pulley.
3. To adjust the alignment, use a straight-line, rested against the driving roller pulley, and make sure that the pulley and flywheel are parallel and aligned.

If it proves difficult to do this operation, slacken the belt tension as described in paragraph 8.5. .

4. After completing the procedure, lock down the grub screw again.

8.5. TENSIONING THE TREAD-BELT MOTOR DRIVE BELT

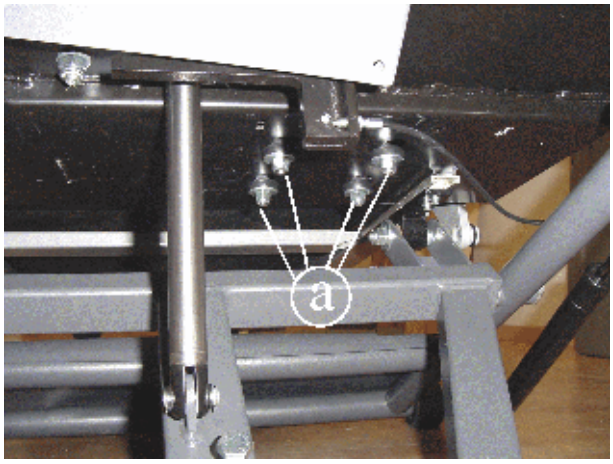

Figure 8.5-1

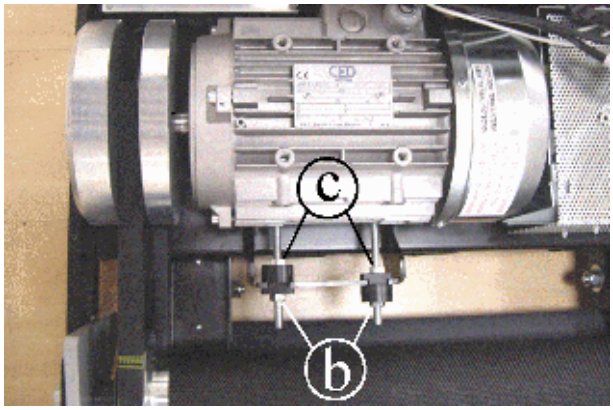

Figure 8.5-2

1. Carry out the procedure described in paragraph 7.8. “Disassembling the motor guard”.

2. Raise the machine to an incline of approximately 5%.
3. Turn off the machine and unplug the mains lead from the wall outlet.

4. Unscrew the 4 nuts a which fix the belt motor to the machine frame using a 13-mm wrench.

5. Back off the 2 outer nuts **b** using a 13-mm wrench.
6. Use a belt tension gauge.
7. Turn the 2 inner adjusting nuts **c** using a 13-mm wrench, until the instrument measures a tension of 35 Kg.

If a belt tension gauge is not available, the belt tension is correct when:

- **it yields by 0.5 – 1 cm when pressed vertically with the hand.**
- **it does not slip when the tread-belt is blocked at 1.0 Km/h.**

After completing this procedure lock down the fixing nut according to the torque values described in paragraph 7.9. “Disassembling the tread-belt motor” and check the belt tension again.

8.6. CALIBRATING THE TREAD-BELT SPEED

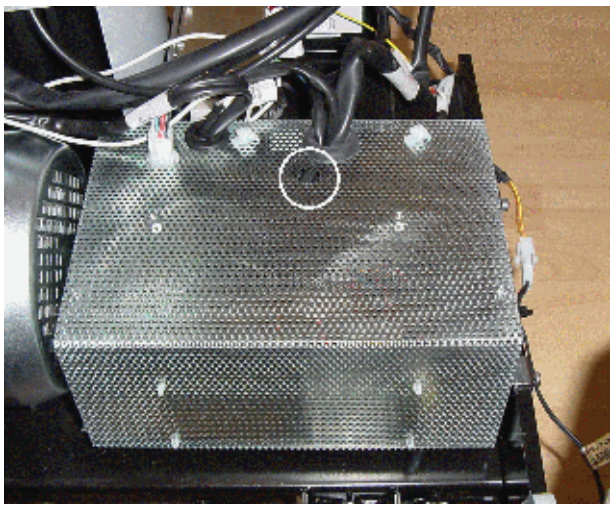

Figure 8.6-1

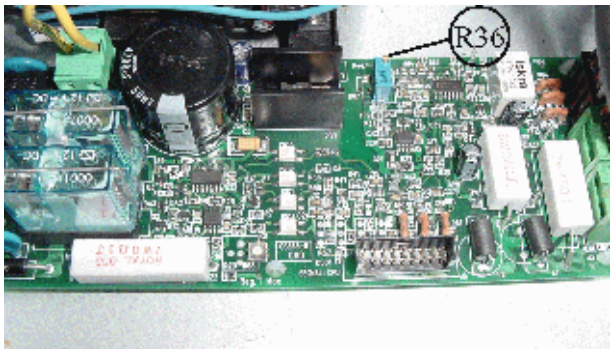

Figure 8.6-2

1. Carry out the procedure described in paragraph 7.8. “Disassembling the motor guard”.

The operations described below must be carried out with the machine powered up; they should be performed exclusively by a QUALIFIED TECHNICIAN who must ensure that there are no unauthorized persons near the machine.

2. Plug the mains lead into the wall outlet.
3. Turn on the machine.

4. Start the tread-belt and set the speed at 8.0 Km/h.
5. View the tread-belt motor control frequency on the inverter display.
6. Adjust trimmer **R36** on the driver board, accessed through the hole on the electrical box, as shown in the figure, using a small flat-blade screwdriver, until the inverter displays a frequency of 39.8 Hz.

If it is impossible to carry out the operation by the hole on the electronic box, open it and adjust the trimmer shown in figure.

8.7. ADJUSTING THE UP-DOWN MOTOR CURRENT LIMITER

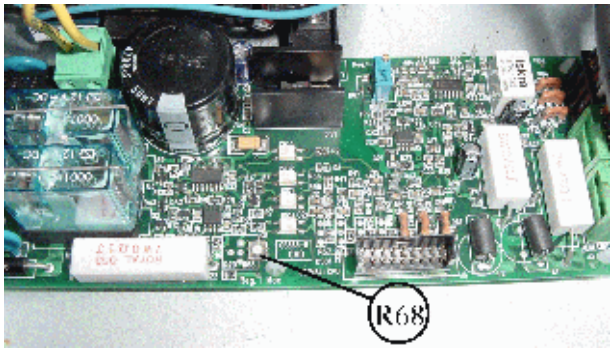

Figure 8.7-1

1. Carry out the procedures described in paragraph 7.15. "Disassembling the electronic circuit boards".

The operations described below must be carried out with the machine powered up; they should be performed exclusively by a QUALIFIED TECHNICIAN who must ensure that there are no unauthorized persons near the machine.

2. To adjust the current limiter setting, turn the screw of trimmer **R68** on the driver board using a small flat-blade screwdriver, until the optimal level is attained.

WARNING: do not move this trimmer unless absolutely necessary. In any case, always check the reason why the current increase is necessary (increased friction, mechanical parts obstructing the movement, electrical problems with the motor) before adjusting the trimmer.

WARNING: after adjusting the trimmer to increase the motor current, always check that its value does not exceed 5 A, which is the maximum current permitted by the motor.

8.8. LEVELING

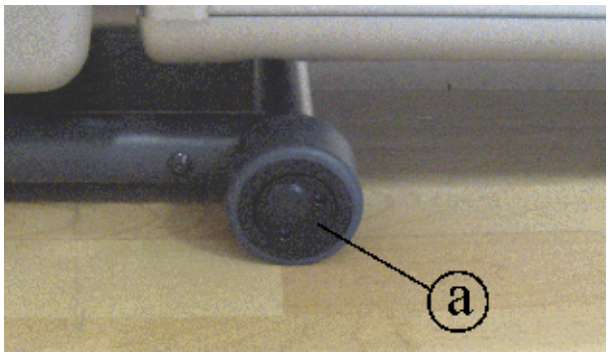

Figure 8.8-1

1. Remove the plastic cap **a** from one of the two rear wheels.

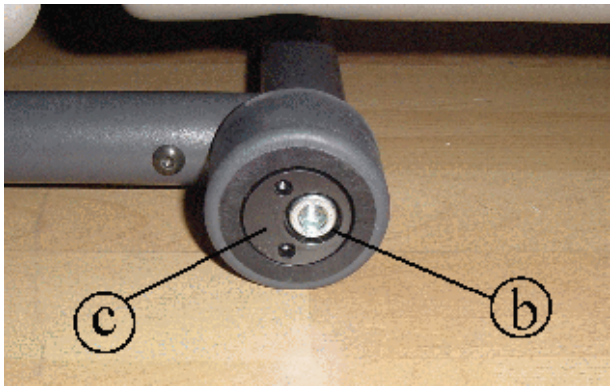

Figure 8.8-2

2. Back off the screw **b**, using an 8-mm hex wrench.
3. Rotate cam **c** using the special tool provided, until all four wheels touch the ground.
4. Lock down screw **b**, holding the cam in place.

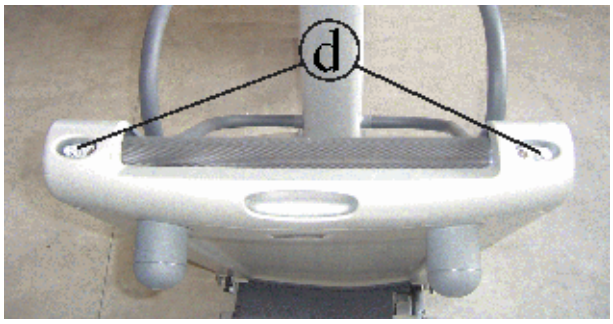

Figure 8.8-3

5. If the two rear feet do not touch the ground, to adjust them it is necessary to remove the rear cover as follows:
   - Back off the two screws **d** using a 6-mm hex wrench;
   - remove the cover;

Continued on the following page →

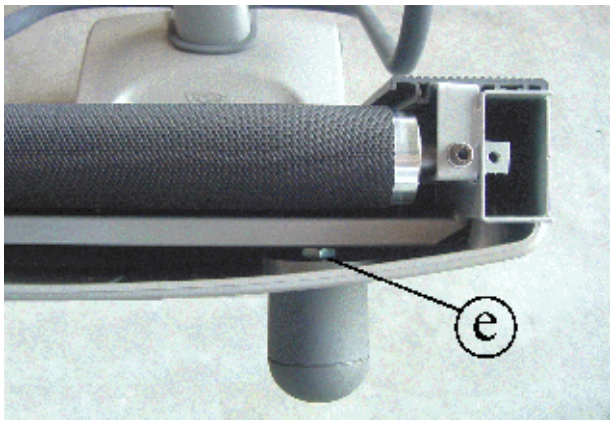

Figure 8.8-4

6. Back off lock-nut **e** and rotate the foot to adjust it.
7. After completing the operation, reassemble the components by carrying out the above steps in reverse order.

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9. MACHINE CONFIGURATION

9.1. LANGUAGE CONFIGURATION

To call up the language configuration procedure, simultaneously press the “1”, “3” and “4” keys with the machine in stand by mode. The machine display shows:

		P	A	S	S	W	O	R	D		
						0					

To access the procedure, type in the password which protects against unauthorized access. After entering the password “2406” and pressing “Enter” to continue, the machine displays the current language setting and indicates whether it has detected the presence of the TGS reader. The following appears on the LCD:

		I	T	A	L	I	A	N	O		
		T	G	S			O	F	F		

Press the “↓” key to advance to the next parameter, press “↑” to go back to the preceding parameter, or press the “Clear” key to quit the procedure. The available languages are:

- Italiano;
- UK English;
- USA English;
- Francais;
- Deutsch;
- Español.

9.2. VIEWING THE WORKING PARAMETERS

In order to check the state of wear of the machine and correctly carry out routine machine maintenance, a special procedure is provided for viewing the values of the working parameters. It is called up by simultaneously pressing the “1”, “3” and “4” keys with the machine in standby mode. The machine display shows:

		P	A	S	S	W	O	R	D		
						0					

To access the procedure, type in the password which protects against unauthorized use. After typing in the password “1508” and pressing “Enter” to proceed, the machine display shows:

9.2.1. HOURS OF MACHINE OPERATION

The total hour count of machine on-time.

	O	N		H	O	U	R	S	=		
							X	X			

 **This value is not updated if it is less than 20 minutes.**

Press the “Enter” key to proceed, or “Clear” to interrupt.

9.2.2. HOURS OF TREAD-BELT MOTOR OPERATION

The total hour count of tread-belt motor operating time.

M	O	T	O	R		H	O	U	R	S	=
							X	X			

Press the “Enter” key to proceed, “Clear” to interrupt.

9.2.3. MINUTES OF UP-DOWN MOTOR OPERATION

The total minute count of up-down motor operating time.

U	P	-	D	O	W	N		M	I	N	=
							X	X			

Press the “Enter” key to proceed, “Clear” to interrupt.

9.2.4. DISTANCE COVERED

The number of Km covered by the machine.

K	M		C	O	V	E	R	E	D		=
							X	X			

Press the “Enter” key to proceed, “Clear” to interrupt.

9.3. MODIFYING THE WORKING PARAMETERS

The procedure for setting the values of the machine's working parameters (for example, after having replaced the CPU board) is called up by simultaneously pressing the "1", "3" and "4" keys with the machine in standby mode. The machine display shows:

		P	A	S	S	W	O	R	D		
						0					

To access the procedure, type in the password which protects against unauthorized use. After typing in the password "2709" and pressing "Enter" to proceed, the machine display will show:

9.3.1. HOURS OF MACHINE OPERATION

The total hour count of machine on-time.

		O	N		H	O	U	R	S	=	
							X	X			

Use the number keys to change the displayed value or press "Enter" to proceed.

9.3.2. HOURS OF TREAD-BELT MOTOR OPERATION

The number of hours for which the tread-belt motor has been running.

M	O	T	O	R		H	O	U	R	S	=
							X	X			

Use the number keys to change the displayed value, or press "Enter" to proceed.

9.3.3. MINUTES OF UP-DOWN MOTOR OPERATION

The number of minutes for which the up-down motor has been running.

U	P	-	D	O	W	N		M	I	N	=
							X	X			

Use the number keys to change the displayed value, or press "Enter" to proceed.

9.3.4. DISTANCE COVERED

The number of Km covered by the machine.

K	M		C	O	V	E	R	E	D		=
							X	X			

Use the number keys to change the displayed value, or press "Enter" to proceed.

9.4. UP-DOWN TEST

The procedure for testing the machine's up-down motor is invoked by simultaneously pressing the "1", "3" and "4" keys when the machine is in standby mode. The machine display shows:

		P	A	S	S	W	O	R	D		
						0					

To access the procedure it is necessary to type in the password which protects against unauthorized use. After entering the password "2512" and pressing "Enter" to proceed, the machine initiates the test:

- starts the tread-belt at 1 Km/h;
- increases the incline to 12%;
- on reaching this elevation, pauses for approximately 1 minute;
- returns the incline to 0%;
- on reaching this elevations, again pauses for 1 minute;
- increases the incline to 12%;

and so on until the "Stop" key is pressed.

9.5. PROGRAMMING THE HITACHI SJ100 INVERTER

The inverter can be programmed using the special keypad installed on board the machine. It is necessary to correctly configure the values of the main functions labeled with an F, and those of the extended functions labeled with A, b, C and H.

If programming an inverter that is not assembled on the machine, before proceeding with the other operations:

- **connect the mains power supply to terminals L1 and N;**
- **place a jumper between terminals 1 and P24;**
- **place a jumper between terminals AL1 and AL0.**

When the inverter is energized, function parameter d01 appears on the display: this is the inverter output frequency toward the motor.

To display the inverter monitor parameters (d type) or those of another main function:

1. Press the “1” or “2” key until the desired main function appears.
2. Press the “FUNC” key once to display the value of the parameter.
3. To modify the value, press the “1” key to increase or the “2” key to decrease.
4. To exit and save the modified value, press the “STR” key; to exit without saving press the “FUNC” key. After this, the display will revert to showing the selected main function.

To display the extended function parameters:

1. Press the “1” or “2” keys to display the desired function: A--, b--, C-- o H--.
2. Press the “FUNC” key to display the code of the extended function: for example the display will show A01.
3. Press the “1” or “2” key until the desired extended function appears. The display of the extended function parameters is cyclical, and after scrolling the type A parameters it goes on to type b and so on.
4. Press the “FUNC” key once to display the value of the parameter.
5. To modify the value, press the “1” key to increase or the “2” key to decrease.
6. To exit and save the modified value, press the “STR” key; to exit without saving press the “FUNC” key. After this the display reverts to showing the selected extended function.
7. To exit extended function menu, press the “FUNC” key until it shows A--, b--, C-- o H--.

Incorrect programming of the inverter may result in serious damage to the machine or improper operation potentially hazardous for the user. Therefore, carry out this operation only if certain of being able to perform the procedure correctly.

WARNING: when the programming has been completed, remember to set displayed the value of the parameter d01 (motor frequency).

9.5.1. MONITOR FUNCTION PARAMETERS

Parameter	Description
d01	Motor output frequency
d02	Motor current draw
d04	Direction of movement
d05	Status monitor of intelligent terminal input signals
d06	Status monitor of intelligent terminal output signals
d07	"Converted" motor output frequency
d08	Monitor of last alarm condition
d09	List of the last error conditions

9.5.2. MODIFIED PARAMETER SETTINGS

The following table shows the parameters which must be configured with a different value from the inverter defaults:

Parameter	Description	Value
A03	Base frequency setting	50
A04	Maximum frequency setting	80
A44	V/F Characteristic curve selection	02
A81	Selection of AVR function	01
A82	Selection of voltage of AVR function for the motor	240
b01	Selection of restart mode	02
b02	Allowable under voltage power failure time	25.0
b03	Time delay enforced before motor restarted	0.3
b12	Level of electronic thermal setting	8.00
b13	Electronic thermal characteristic	01
b22	Level of overload restriction setting	12.00
b83	Carrier frequency setting (KHz)	16.0
b90	Dynamic braking usage ratio	20
C03	Function of terminal 3 setting	12
C13	Condition of terminal 3 setting	01
F-02	Acceleration	10.0
F-03	Deceleration	10.0
H01	Auto-tuning setting	00
H02	Motor data selection	01
H03	Motor capacity setting	1.5
H04	Motor poles setting	4
H05	Motor constant K_p setting	20
H06	Motor stabilization constant	100
H30	Motor constant R1 (Autotuning data)	1.124
H31	Motor constant R2 (Autotuning data)	1.500
H32	Motor constant L (Autotuning data)	8.99
H33	Motor constant Io (Autotuning data)	3.95
H34	Motor constant J (Autotuning data)	20

10. SCHEDULED MAINTENANCE

To keep the machine in perfect working order, it is necessary to carry out certain scheduled maintenance actions in order to forestall possible problems. There are essentially 3 types of maintenance operations:

- Daily maintenance operations;
- Fortnightly maintenance operations;
- Bimonthly maintenance operations;
- Yearly maintenance operations.

The prescribed frequency differs for each type of operation, as does the required level of operator qualification. The following paragraphs detail the recommended procedures.

10.1. DAILY MAINTENANCE OPERATIONS

These operations can be carried out by the machine owner and do not require any special skills.

The daily maintenance operations are simple cleaning actions for the purposes of general hygiene.

For daily maintenance, proceed as follows:

10.1.1. SETTING UP THE OPERATION

1. Turn off the machine by placing the switch in the 0 (OFF) position.
2. Unplug the mains lead from the wall outlet.

10.1.2. CLEANING OPERATIONS

1. Using a cloth moistened with a neutral (non acidic) soap, clean the entire machine, taking care not rub too hard, especially on the display keys.

Never spray the cleaning product directly on the machine.

WARNING: do not use alcohol, gasoline or other chemical products.

10.2. FORTNIGHTLY MAINTENANCE OPERATIONS

These operations can be performed by the machine owner and do not require any special skills.

The fortnightly maintenance operations involve simple cleaning and lubrication actions and checks on the safety devices, in order to ensure correct and safe operation of the machine.

For the fortnightly maintenance of the machine, proceed as follows:

10.2.1. LUBRICATION OPERATIONS OF TREAD BELT AND RUNNING DECK

1. Lubricate the full length of the surface between the tread belt and the running deck, using the oil can and special tube provided in the service box, inserting the tube between the tread belt and the running deck at the front of the frame.
2. Start walking on the machine at a speed of approximately 5 km/h, being careful to tread on the full width of the belt so as to distribute the oil evenly over its entire surface.

10.2.2. CHECKING THE "SAFETY SWITCH"

1. With the machine turned on and running at approximately 5 Km/h, operate the safety switch and check that the machine stops and shows the "SAFETY SWITCH" message on the display.

10.2.3. COMPLETE OPERATION

1. Check that, when it is switched on, the machine performs the power-on self test procedure which:

   - sounds the buzzer
   - illuminates all the LEDs
   - resets the incline

   At the end of which the machine goes into standby, awaiting a keyboard command.
2. To check the correct operation of the machine:

   - get on the machine
   - press the "Start" key to begin the exercise
   - check that the tread belt motor starts
   - press the "+" and "-" keys on the keyboard and check that the tread belt speed varies accordingly
   - press the "↑" and "↓" keys and check that the incline varies accordingly;
   - put on the heart rate meter and check that the machine correctly reads the heart rate value.

10.3. BIMONTHLY MAINTENANCE OPERATIONS

These operations can be performed by the machine owner and do not require any special skills.

The bimonthly maintenance operations involve simple cleaning and lubrication actions and checks on the state of wear, in order to ensure correct and safe operation of the machine.

For the bimonthly maintenance of the machine, proceed as follows:

10.3.1. INTERNAL CLEANING OPERATIONS

1. Turn off the machine, by placing the switch in the 0 (OFF) position.
2. Unplug the mains lead from the wall outlet.
3. Open the motor guard.
4. Clean the interior using a vacuum cleaner, taking particular care with the tread-belt motor, the inverter and the electronic circuit boards.

WARNING: when carrying out these operations, be careful not to damage the cables.

5. Move the machine and clean the floor under the machine using a vacuum cleaner.

10.3.2. CHECKING THE STATE OF WEAR

1. With the machine stopped, check the state of wear of the entire surface of the tread-belt, turning it by hand. If it shows signs of damage or wear, replace it or call in the authorized Technogym Technical Service.

10.3.3. CHECKING THE TENSION AND CENTERING OF THE TREAD-BELT

1. With the machine running at minimum speed, attempt to stop the tread belt by stepping on it. If the tread belt slips, replace it or call in an authorized Technogym service technician.
2. With the machine running at approximately 10 Km/h, check the centering of the tread-belt. If any problems are observed, call in the authorized Technogym Technical Service or adjust the centering.

10.3.4. CHECKING THE DISPLAY

1. Check the operation of all the keys on the keyboard.
2. Check the operation of all the LEDs and the buzzer.

10.3.5. CHECKING THE WEAR OF THE RUBBER HANDLEBAR COVER

1. Check the state of wear of the rubber covers on the 2 side handlebars and on the center handlebar. Replace if there are evident signs of wear.

10.4. YEARLY MAINTENANCE OPERATIONS

These operations can only be carried out by a qualified technician specifically trained by Technogym and authorized to carry out machine installation and adjustments, as well as special maintenance operations or repairs which require special knowledge of the machine, its operation, safety systems and working procedures.

The **yearly** maintenance operations involve checking the operation, wear and tension of the mechanical components so as to ensure perfect and safe operation of the machine.

For the yearly maintenance of the machine, proceed as follows:

10.4.1. CARRYING OUT THE ROUTINE MAINTENANCE PROCEDURE

1. Carry out the procedures described in paragraph 10.3. “Bimonthly maintenance operations”.

10.4.2. CHECKING THE WORKING CONDITIONS

1. Check that the machine is connected directly to the wall outlet, without any extension cords, and that the outlet is correctly earthed.
2. Using a tester, check that the machine earth node is correctly connected to earth.

10.4.3. CHECKING THE WIRING AND CONNECTIONS

1. Open all the machine guards.
2. Check the condition of all the cables:

   - External conditions;
   - Possible rusting of the connectors;
   - Electrical continuity of the individual wires;
   - Isolation of the individual wires toward ground.

   Repair and/or replace any non-conforming wires.

3. Check the condition of the fuse using a tester.

10.4.4. CHECKING THE WEAR AND LUBRICATION OF THE TREAD-BELT AND RUNNING TRACK

Every 10000 km, or any time the tread belt or the rollers are disassembled, it is recommended to perform the following checks:

1. Disassemble the rear and motor rollers, the running track and tread-belt.
2. Using a cloth, clean the entire surface of the running track and the inside of the tread-belt.
3. Check the state of wear of both the running track and tread-belt. Replace if they show significant signs of wear.
4. Next, lubricate the full length of the running track and tread-belt with Silube spray oil.
5. After reassembling the machine, start the tread-belt at approximately 3 Km/h and walk on it, taking care to tread on the entire width of the belt, so as to facilitate the uniform distribution of the oil on its surface.

10.4.5. CHECKING THE WEAR OF THE MOTOR ROLLER

1. With the rear and motor rollers, running track and tread-belt disassembled, check the state of wear of the motor roller and clean it to remove any deposits. Replace if there are evident signs of wear.
2. With the machine in motion, check the noisiness of the bearings. Replace in the event of excessive noise.

10.4.6. CHECKING THE WEAR OF THE REAR ROLLER

1. With the front and rear rollers, running track and tread-belt disassembled, check the state of wear of the rear roller and clean it to remove any deposits. Replace if there are evident signs of wear.
2. With the machine in motion, check the noisiness of the bearings. Replace in the event of excessive noise.

10.4.7. CHECKING THE SHOCK ABSORBERS

1. With the front and rear rollers, running track and tread-belt disassembled, check the condition of the shock absorbers on either side of the running track. Replace if there are cracks or signs of breakage.

10.4.8. CHECKING THE TREAD-BELT MOTOR DRIVE-BELT

1. Turn off the machine by placing the switch in the 0 position (OFF).
2. Unplug the mains lead from the wall outlet.
3. Open the motor guard.
4. Check the state of wear of the tread motor drive-belt, turning it by hand using the motor flywheel. Replace if it shows evident signs of wear.
5. Check the tension of the motor drive-belt. Adjust the tension if necessary.

10.4.9. CHECKING THE SPEED CALIBRATION

1. Open the motor guard.
2. Check that, when the machine runs at a speed of 8.0 Km/h, the inverter displays a working frequency of 39.8 Hz.

WARNING: this must be done with the machine opened and powered up.

10.4.10. CHECKING THE OPERATION OF THE CARDIO RECEIVER

1. Using a separate heart rate monitor, put on the transmitter strap and check that the machine and the separate monitor both measure the same heart rate, and that when the strap is disconnected the machine does not receive any signal.
2. Using a heart rate frequency simulator, check that the machine detects the variations in the heart rate.

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11. APPENDIX

11.1. TECHNICAL NOTES ON CARDIO RECEIVERS

Technogym utilizes Polar technology for measuring the heart rate frequency of the person training on the machine. The Polar system consists of:

- a **transmitter**, worn by the person training on the machine, which uses 2 electrodes to detect the electrical activity of the heart and transmits the measured heart rate by sending an electromagnetic signal at a frequency of 5 kHz.

- a **receiver**, shown in the figure below, which consists of:

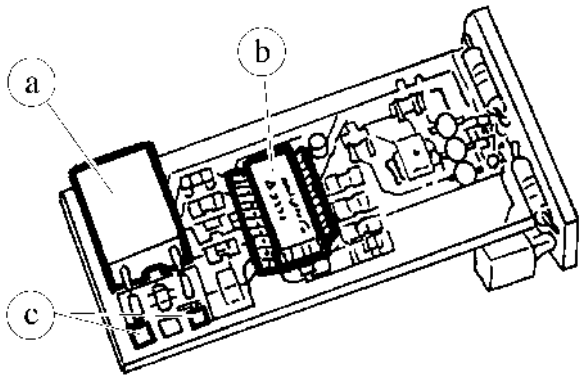


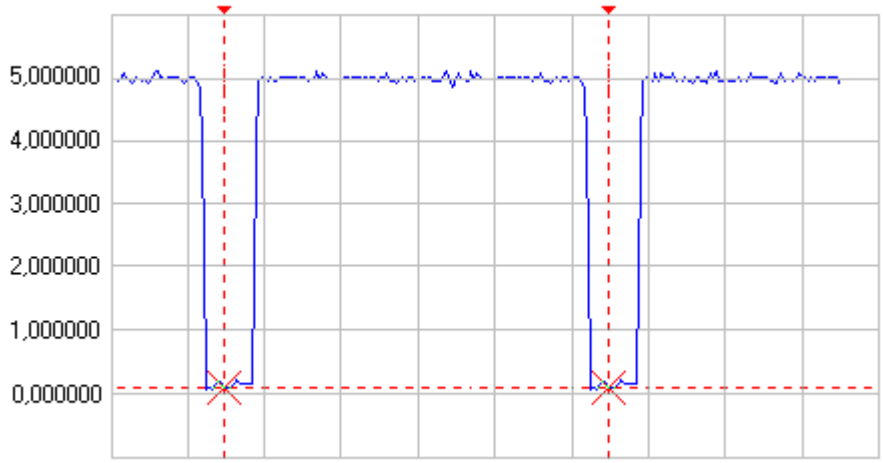
Figure 11.1-1

- an antenna **a**, designated the "coil", which receives the signal from the transmitter strap worn by the user.
- an integrated circuit **b**, designated the ASIC, which has the function of filtering the analog signal and generating a pulse train corresponding to the received heart rate.
- two contacts **c** parallel to the coil, on which a 15 KOhm resistor is sometimes mounted.

The receiver is connected to the CPU board by means of 3 wires for:

- +5 Vdc power supply;
- Output signal (heart rate);
- ground.

The output is a digital signal that is normally at 5 Vdc and goes to 0 Vdc for a few msec when a heart beat is detected, as shown in the figure below.



There are 3 types of problems which can typically occur on the heart rate signal:

- **interference** caused by disturbances from sources of electromagnetic noise. These problems cause the heart rate signal to deviate from the rear value, typically making it higher;
- **saturation** caused by disturbances from sources of electromagnetic noise. In this case the receiver is no longer able to detect any heart rate signal;
- **cross-talk** similar to the interference problem, but is caused by reception of a signal from another strap, typically worn by users on adjacent machines if they are too close together.

The following paragraphs contain various suggestions which may be useful for improving the reception of the cardio signal.

11.1.1. TYPE OF ASIC

The cardio receivers can be equipped with 3 different types of ASIC models, identifiable by the code marked on the component: MAS, FTC or HRRE. These ASICs are characterized by different reception ranges and different levels of immunity to noise. Tests have determined that the maximum reception distances are as follows:

ASIC	DISTANCE (cm)
MAS	90
FTC	100
HRRE	85

As regards sensitivity to noise, the best ASIC is the HRRE model. This ASIC is also the one recommended by the manufacturer.

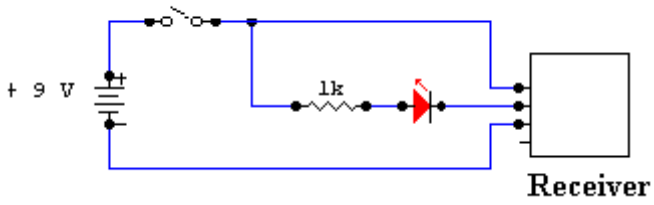
11.1.2. PRESENCE OF ELECTROMAGNETIC FIELDS

The receiver is sensitive to electromagnetic fields produced by the switching of LEDs, motor brushes, the commutation of power devices, monitors, neon lights, stereo equipment, etc., which can impair its operation. It has been found that such electromagnetic fields directly affect the analog part

of the receiver (detected by the coil) whereas they have no effect on digital components such as the CPU receiver connecting cable.

Electromagnetic interference can take different forms: on the one hand, the receiver may detect and hence generate spurious transients or periodic noise pulse, or on the other hand the receiver may become saturated. The presence of **transients** is generally accompanied by irregular blinking of the heart rate LED on the display, but does not affect the value shown which is processed by special SW filters. The presence of **periodic noise pulse** effect the heart rate signal. **Saturation of the receiver**, on the other hand, is a phenomenon which, depending on its intensity, can reduce the maximum reception distance until it becomes completely impossible to receive a signal.

In the presence of electromagnetic noise, use the frequency signal monitor shown in the schematic below to determine the presence, intensity and effect of the fields.



This circuit causes the LED to light for every heart beat and/or transient detected: in this way it is possible to determine whether there is electromagnetic noise, and identify its source.

The only effective solution in the presence of electromagnetic interference is to reduce the power of the noise source, using a trial and error method based principally on:

- Shielding the noise source.
- Increasing the distance between the noise source and the receiver, if necessary by changing the position of the machines.

It is also possible to reduce the receiver's ability to detect interference by:

- Changing the position of the receiver;
- Reducing the sensitivity of the receiver (see paragraph 11.1.3.)
- In some cases, it was found to be effective to screen the receiver inside a tagger box having a thickness of 0.15 mm.

Please note that these are merely some possible suggestions, and that the effectiveness of the chosen solution must be verified in practice.

11.1.3. REDUCING RECEIVER SENSITIVITY

It is possible to diminish the receiver's sensitivity in order to reduce its range of reception. This solution is recommended in the following cases:

- presence of electromagnetic fields which interfere with reception or saturate the receiver;
- problems due to interaction between the receiver on one machine and the signal transmitted by a user training on another machine that is too close and cannot be moved farther away.

Sensitivity is reduced by soldering a resistor in parallel with the coil. Normally, the receiver already has a 15 KOhm resistor mounted in parallel with the coil, however it is advisable to check for its presence.

The following table shows the nominal values of reception distance based on the value of the resistor soldered on the coil:

RESISTANCE (Ohm)	DISTANCE (cm)
15K	89
13K	88
11K	87
9K1	85
6K8	84
5K1	81
3K	74
2K	69
1K	57

Please note that these are only nominal values. The actual reduction in sensitivity must be verified experimentally, taking great care not to excessively reduce the reception distance.

WARNING: if there is already a 15 KOhm resistor mounted in parallel with the coil, note that adding another resistor in parallel will produce a total resistance value equivalent to the parallel combination of the added resistor and the existing 15 KOhm resistor.

11.1.4. MECHANICAL VIBRATIONS

Mechanical vibrations may cause slight shifting of the coil, giving rise to transient impulses. If these transients occur only occasionally they can be easily filtered by SW. However, if the mechanical vibrations are periodic, they can produce periodic pulses which may be interpreted as correct heart rate values.

To eliminate or reduce the effects of vibration, house the receiver between the foam pads in such a way that any vibrations are correctly damped.

WARNING: when securing the foam pads and the receiver with a strap, be careful not to overtighten the strap as this may reduce the damping capacity of the foam pad.

11.1.5. POSITION OF THE RECEIVER

Carefully position the receiver according to the specifications below:

- the coil must be directed toward the user;
- the coil must be positioned well away (even a few centimeters) from the LEDs;
- the cable must be folded immediately after the connection on the receiver, so that it does not pass near the coil;

- the receiver must be directed in such a way that its axis of reception is parallel to that of the transmitter, as shown in the figure below:

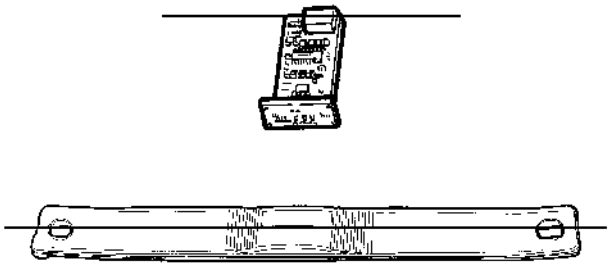


Figure 11.1-2

Please note that even small departures from the above specifications may considerably impair the accuracy of reception.

The optimal configuration is therefore that shown in the figure below:

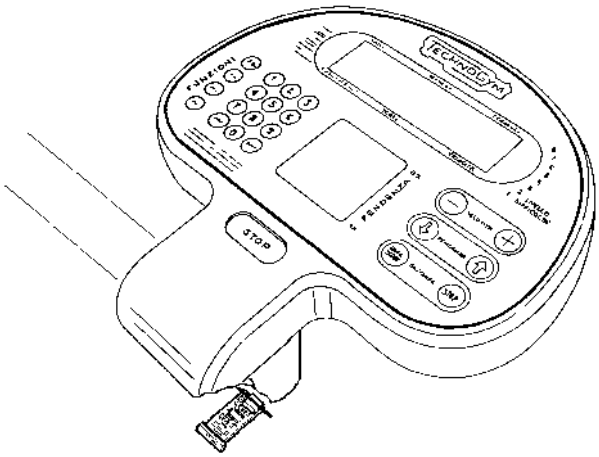


Figure 11.1-3

11.1.6. ROUTING OF CABLES

Particular care must be taken in the routing of cables to prevent interference with the receiver coil.

11.2. HITACHI SJ100 INVERTER ERROR CODES

The inverter memorizes all the errors detected during operation, in the form of a code which indicates the cause of the error. The table below lists the error codes and their meaning, as referred to in chapter 6.

DESCRIPTION	CAUSES		ERR.
Power circuits protection	A short-circuit on an inverter output or a motor block causes a high current to flow, generating this error. If the current or temperature of the principal components exceeds a preset threshold, the output is disconnected.	Constant speed	E01
		Deceler.	E02
		Acceler.	E03
		Stop	E04
Overload protection	When the internal thermostat of the inverter detects a motor overload, the output is disconnected.		E05
Braking resistor overload	When the external resistor is used too frequently, and an overvoltage is detected caused by interruption of the BRD function, the output is disconnected.		E06
Overvoltage protection	When the voltage exceeds a preset threshold, due to motor regeneration phenomena, this safety is tripped and the output is disconnected.		E07
EEPROM error	When an error is detected on the EEPROM memory which stores the working program, the output is disconnected.		E08
Low voltage protection	A drop in the input voltage below 150-160 V triggers this error, and the output is disconnected.		E09
CT error	When a major noise source is situated near the inverter, or there is a malfunction in the internal current transducer circuit, the output is disconnected.		E10
CPU error	If a malfunction is detected in the internal CPU, the output is disconnected.		E11
			E22
External shutdown	One of the motor thermal cutouts has opened, the inverter has detected it and disconnected the output.		E12
USP error	Appears if the inverter is turned on with the start key pressed (non in use on Spazio Forma).		E13
Ground short circuit protection	If one of the inverter phases has a leak or short-circuit to ground, the output is disconnected.		E14
Overvoltage protection	If the input voltage increases more than 10% above its nominal value for at least 100 seconds, this safety is tripped and the output is disconnected.		E15
Thermal cutout	If the temperature sensor inside the inverter detects an overtemperature condition, the output is disconnected. In this condition, the dissipator reading is 80 °C.		E21
PTC error	Problem with the PTC sensor (not used on Spazio Forma).		E35

To display the inverter error codes, follow the instructions below or refer to pages 8-2 of the inverter manual:

1. Remove the motor guard.
2. Turn on the machine.
3. Repeatedly press the “1” or “2” key on the inverter keypad until the display shows “d08”.
4. Press the “FUNC” key to display the last error which occurred. The following will sequentially appear:

   - error code;
   - output frequency when the error occurred;
   - motor current when the error occurred;
   - motor voltage when the error occurred;

   To advance to the next value, press the “FUNC” key.

5. To view all the logged errors in inverse chronological order, display the function “d09”and press the “FUNC” key. Each time this key is pressed the inverter memory goes back one error.

ATTENTION: Be very careful not to touch any other keys, or to touch the aforesaid keys at the wrong time, as this can seriously damage the inverter configuration, leading to malfunctioning of the machine.

11.3. PROCEDURE FOR CLEARING THE ERROR MEMORY ON HITACHI SJ100 INVERTER

For all Hitachi SJ100 inverters, it is available an easy procedure for clearing the error memory. To do this:

1. Turn on the machine;
2. Configure parameter **b84** = **00**;
3. Come back to the visualization of the parameter **b84** and press simultaneously the keys **FUNC**, ↑, ↓;
4. Holding down the three keys, press also **Stop/Reset** key for about 1 second and wait for about 3 seconds, until the blinking **d00** is shown on the display.
5. Now release all keys again. The initializing phase that now begins will be complete as soon as the display **00** appears. The errors' memory now will be clear.

11.4. PROCEDURE FOR CLEARING PARAMETERS ON HITACHI SJ100 INVERTER

For all Hitachi SJ100 inverters, it is available an easy procedure for resetting parameters to the factory setting. To do this:

1. Turn on the machine;
2. Configure parameter **b85** = **01**;
3. Configure parameter **b84** = **01**;
4. Come back to the visualization of the parameter **b84** and press simultaneously the keys **FUNC**, ↑, ↓;
5. Holding down the three keys, press also **Stop/Reset** key for about 1 second and wait for about 3 seconds, until the blinking **d00** is shown on the display;
6. Now release all keys again. The initializing phase that now begins will be complete as soon as the display **00** appears. The parameters will be reset to the factory setting.

11.5. TOOLS TO USE

The following tools are necessary to carry out all disassembly, adjustment and maintenance operations on the machines:

- Small flat-hand screwdriver;
- Small-sized Philips screwdriver;
- Medium-sized Philips screwdriver;
- 10-gauge wrench;
- 13-gauge wrench;
- 17-gauge wrench;
- 19-gauge wrench;
- 7-socket spinner wrench;
- 2.5-gauge hexagonal T-wrench;
- 3-gauge hexagonal T-wrench;
- 4-gauge hexagonal T-wrench;
- 5-gauge hexagonal T-wrench;
- 6-gauge hexagonal T-wrench;
- 8-gauge hexagonal T-wrench;
- 10-gauge hexagonal T-wrench 14;
- Special tool provided by Technogym for the eccentrics of the wheels;
- Torque wrench.
- Hammer

CAUTION: Tool measurements are expressed in mm.

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