PJ Tech

Metal Detectors

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Rev. 3

SMART-100

TRAMP METAL DETECTOR

CONTROL UNIT

OPERATING INSTRUCTIONS MANUAL

We reserve the right to change contents of this manual due to product innovation or technical improvement.

Contents

1 General information

1.1 Introduction

The texts and illustrations in this instruction manual are for the exclusive purpose of explaining how to operate and handle the control unit. Please check that this is the correct manual for your equipment. PJ TECH accepts no responsibility for damage resulting from the use or misuse of this equipment. All appropriate safety rules and regulations for the use of this equipment must be adhered to. If you have any questions with regard to the installation and operation of this equipment, please do not hesitate to contact us.
This instruction manual must not be copied, saved on computer or otherwise reproduced without prior permission of PJ TECH. Nor should any extract of this instruction manual be similarly reproduced.

1.2 Applications

- Product liability
- ISO 9000
- TQM (Total Quality Management)
- Protection of machines and operators

1.3 Symbols used


Important Notes


Danger Notes


Safety Notes

Warning signs attached to the equipment
These symbols should draw the reader's attention to the accompanying safety notes.

	Danger! Danger – life-threatening risk of electric shock
	Danger! Danger – life-threatening risk of electric shock.
	Danger! Danger – life-threatening risk of electric shock.

1.4 General View

SMART-100 standard version

SMART-100 membrane keypad

2 Technical Data

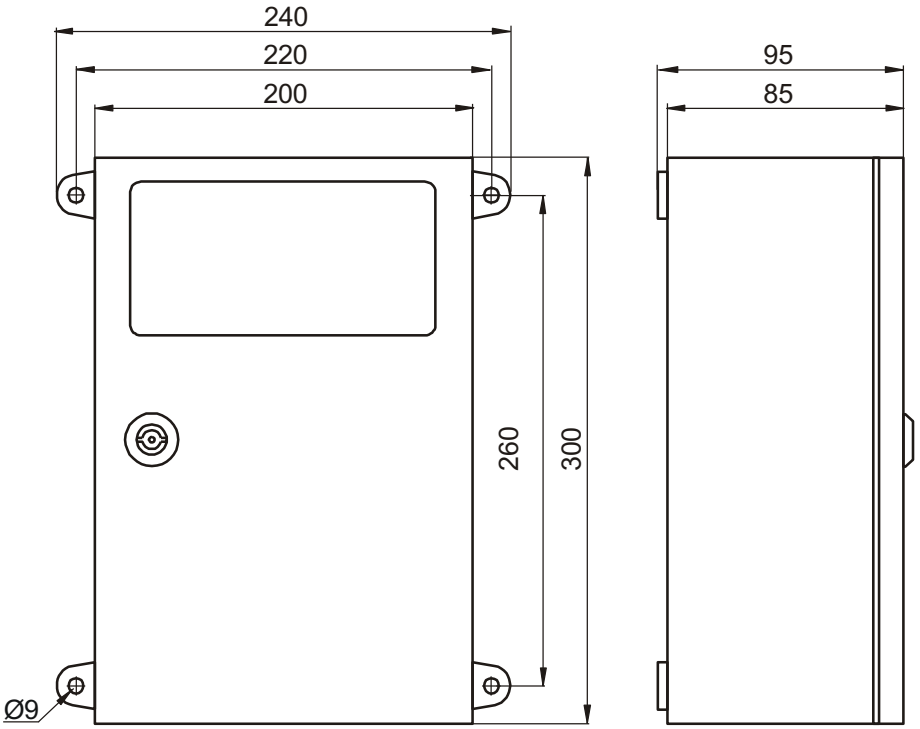
2.1 Performance Data

Name	SMART-100 Control Unit
Housing:	Sheet steel, varnished, pure orange (RAL 2004)
Weight	4.5 kg
Ambient temperature	-10°C to +50°C
Ingress protection	IP 65
Operating voltage	100-240VAC (±10%), 50/60 Hz
Current consumption	200mA/115V, 100mA/230V
Fuse	1.6A, delayed action
Switching inputs	2 switching inputs: “Reset“ and “Swing Away“ 2 switching inputs for initiators: “Clip” sensors
Switching outputs	1 relay switching output for metal signal (Output: Timed Out) 1 relay switching output for fault / alarm signal (Output: Fault) 1 relay switching output for metal signal (Output: Direct Out)
Operation	**Membrane keypad with:** 2-line character display, with 4 key operations Reset / Test button “Operating” light “Fault” light “Metal” light

We reserve the right to change the contents due to product innovation or technical improvement.

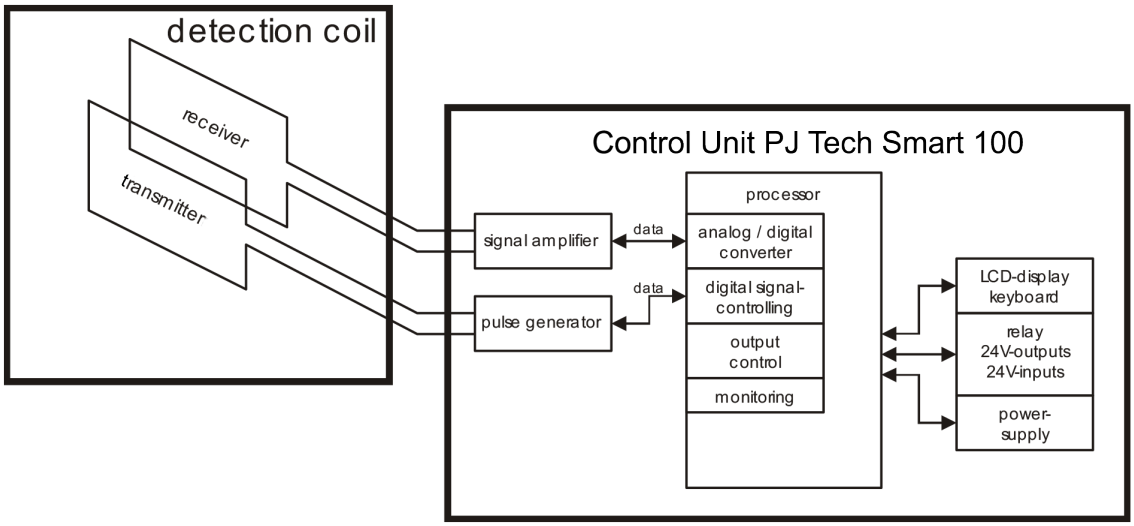
2.2 Dimensions

2.2.1 SMART-100 standard version



All dimensions in mm.

3 Design and method of operation

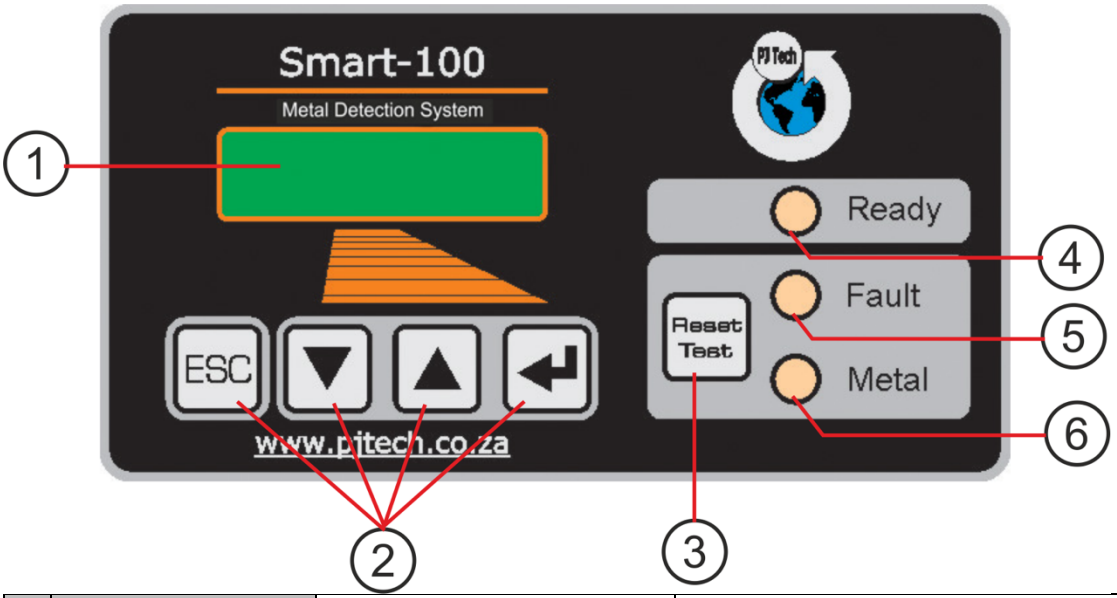


3.1 Functional principle

Any metal impurity in the product flow causes a change in the detector's electromagnetic field. This change is evaluated by the control unit.
The control electronics act as the central communication point for the evaluation electronics, the user, conveyor belt and serial interface.

3.2 Functional and control elements

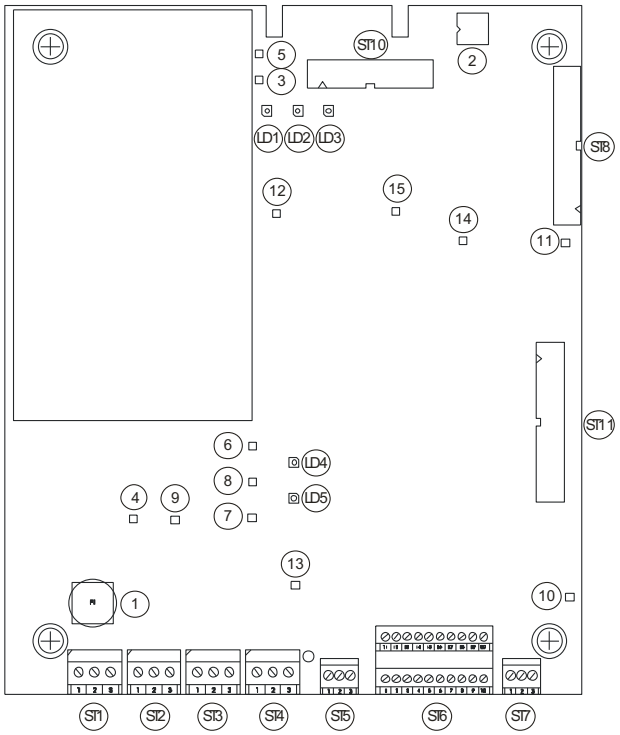
The control panel of the SMART-100 has the following control and indication elements:



1	LCD screen	2 lines, 32 characters	For operation and machine setup
2	Operator keys	ESC, UP, DOWN and ↵ (Enter) buttons	For operation and machine setup
3	Function key	Reset / Test button	Reset to restore the unit after metal or fault signal
4	Green light	Operating	Illuminates when supply voltage is present
5	Red light	Fault	Flashes when fault is detected
6	Yellow light	Metal	Illuminates when metal is detected

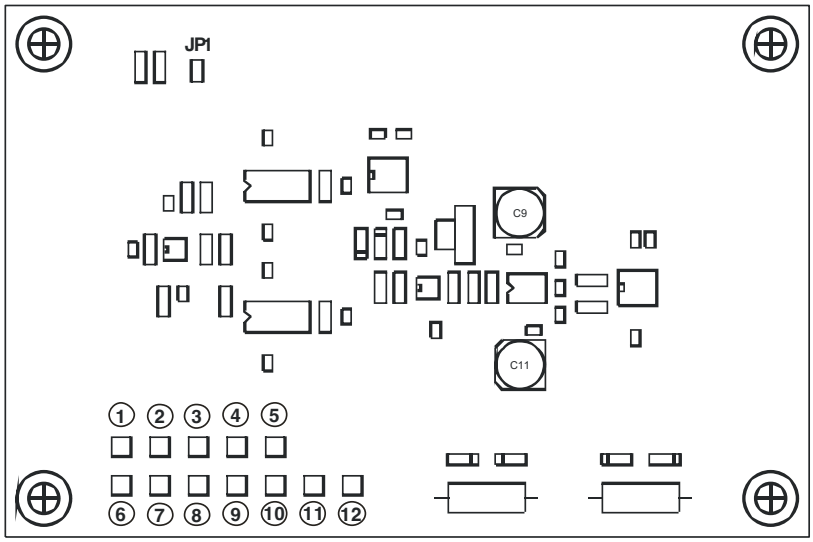
3.3 Electronics board

3.3.1 Main board (Rev.3)



Connectors and terminals:	ST1	"Mains":	Mains supply
	ST2	"Direct Out":	Potential free change over contact
	ST3	"Fault":	Potential free change over contact
	ST4	"Timed Out":	Potential free change over contact
	ST5	"Transmitter"	Transmitter coil
	ST6	1-10: "Inputs"	11-20: "Input/Output"
	ST7	"Receiver"	Receiver coil
	ST8	Ribbon cable connector	Connector for control panel
	ST10	Connector	Serial communication connection
	ST11	Connector	Connection for signal analyser board
Elements connected to mains voltage:	ST1 "Mains" connector		
	(1)	Mains fuses	
Elements connected to external voltage:	ST2	"Direct Out" connector	
	ST3	"Fault" connector	
	ST4	"Timed Out" connector	
Memory devices:	(2)	Machine data	
Lamps:	LD1	Active light supply voltage +5V_D (memory)	
	LD2	Active light supply voltage +24V (Transmitter)	
	LD3	Active light supply voltage -24V (Transmitter)	
	LD4	Active light supply voltage +15V (Ops Amplifier)	
	LD5	Active light supply voltage -15V (Ops Amplifier)	
Test points:	(3)	Supply voltage +24V	
	(4)	Supply voltage -24V	
	(5)	Supply voltage +5V_D	
	(6)	Supply voltage +15V	
	(7)	Supply voltage -15V	
	(8)	Common ground for earth (GND)	
	(9)	Common ground for earth (GND)	
	(10)	Common ground for earth (GND)	
	(11)	Common ground for earth (GND)	
	(12)	Common ground for earth (GND)	
	(13)	Pulse to transmitter coil	
	(14)	Signal from signal analyser (or adapter board)	
	(15)	Signal to controller	

3.3.2 Signal analyser board (Rev.1)



Test points and jumpers on the signal analyser board

Test points:	(1)	Supply voltage +5V
	(2)	Common ground for earth (DGND)
	(3)	Supply voltage +15V
	(4)	Common ground for earth (AGND)
	(5)	Supply voltage -15V
	(6)	DIS / (not used)
	(7)	Me.-signal-OUT from signal analyser
	(8)	Zero pulse Z
	(9)	Enable pulse EN
	(10)	Sample pulse S-
	(11)	Sample pulse S+
	(12)	Analyser identification (+5V)
Jumpers:	JP1	Analyser identification: Jumper must be closed

4 Safety

Our equipment conforms to all official technical safety regulations. However, as a manufacturer we believe it is our duty to make you aware of the following information:

4.1 Intended use

The equipment is to be used in the following applications only with the appropriate detection coil: Conveyor belt application. The ambient temperature of the machine must not exceed 50°C. Ensure that the installation area is free from steam, plasticizers or other materials that may damage the PVC cable sheathing.

4.2 Safety signs

Mains voltage runs through the SMART-100 control unit housing and may also be connected to any external electric circuits (e.g., metal relays).
Therefore, the safety sign shown on the right is displayed on the cover of the electronics housing.

"Mains" connection shown with: (1)

"Direct Out", "Fault" and "Timed Out" (2) (3) (4)

Observe note 4.5 when removing the cover during maintenance or repair.

4.3 Dangers arising from non-compliance with safety notices

Life-endangering electric shocks are likely in cases of non-compliance with the safety notices.

4.4 Safety information for operators

The SMART-100 control unit must be in perfect working order and used for the purpose, for which it was designed, in particular, ensure that the cover of the electronic housing is closed during operation. Any moisture which penetrates the electronic housing must be removed. Safety signage must not be removed and must be maintained in good condition. The instruction manual must remain complete and in good, readable condition. Only qualified personnel must operate, maintain and repair the equipment. People with heart pace-makers should not spend long periods near the detection coil. When inspecting materials which are likely to explode follow the appropriate regulations.

4.5 Safety information for operation and maintenance

Before opening the electronics housing clean the outside area to reduce the risk of dirt and moisture penetrating inside. Disconnect power supply and external circuits before opening the cover. Any moisture which penetrates the electronic housing must be removed.
Only qualified personnel should operate, maintain and repair the equipment.

4.6 Notes on residual risks

Electrical circuits may still be live even after having been isolated from the mains.

4.7 Consequences of unauthorised modification

Unauthorised modification or repair will invalidate all manufacturer declarations and guarantees.

4.8 Improper use

The control unit is not designed for any other use other than that stipulated in section 4.1. All operations must be within the specifications detailed in the technical data. Improper use also includes operating the equipment with excessive mechanical, static or dynamic loads (e.g., heavy machine parts or strong vibration). The inspection of aggressive materials such as those containing alkalis, acids and solvents is not permitted, nor is the equipment to be used in an environment where there is risk of explosion.

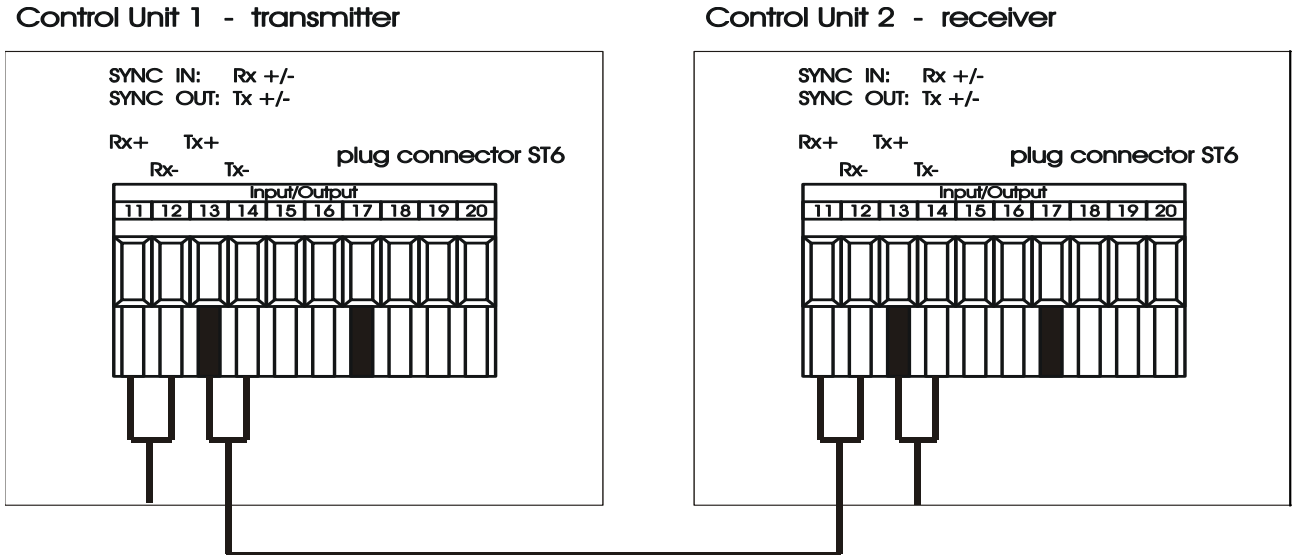
5 Commissioning

5.1 Mechanical Installation

- Ensure that the equipment is securely installed and vibration-free. Installation under cover. Do not install in an environment where there is risk of explosion.
- Do not install in the vicinity of interference fields (e.g.: near large electric motors or frequency inverters). The safe distance depends on the power of the motor or frequency inverter (approx 5m).
- Fix the control unit cabinet to a wall or frame using the 4 screw holes provided (check the drawing for dimensions). Ensure that it is securely fixed to support the weight of the control unit (approx 5kg).
- The control unit must be installed in its own cabinet. On no account install it in other switchgear cabinets as there is a high risk of interference.
- Always discuss with PJ TECH prior to altering cable lengths between the electronic unit and the detection coil. Always use original cables supplied with the machine. These connector cables must be laid separately from other cables (use fixing clips or lay them in separate cable ducting).
- Synchronisation of several metal detection units:

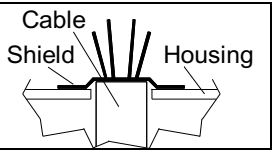
  If several metal detection units at the same frequency are to be installed side by side, a shielded, two-core “Twisted Pair” cable can be used to synchronise them. This must be connected as described below.

  The cable shielding must be connected to the housing in each case (it is possible to cascade several machines in similar fashion):



5.2 Connecting the equipment

All cables external to the electronics and electrical control housings must be **shielded.** The shielding must be earthed immediately after the cable gland.



5.2.1 Pin configuration

5.2.2 Electrical connections

Description	Type of connection	Function		
"Mains"	Connector for mains supply	Mains supply: 100V~ … 240V~, 50Hz … 60Hz		
"Direct Out"	Voltage free relay contact	Normal operation: Contacts 31 and 32 closed On metal detected Contacts 31 and 34 closed		
"Fault"	Voltage free relay contact	Normal operation: Contacts 21 and 24 closed In case of fault: Contacts 21 and 22 closed		
"Timed Out"	Voltage free relay contact	Normal operation: Contacts 11 and 12 closed On metal detected Contacts 11 and 14 closed		
"Input/Output"	24V inputs and outputs	1	+24V	
		2	SIGNAL	(Sensor 1, PNP – upstream CLIP)
		3	GND	
		4	+24V	
		5	SIGNAL	(Sensor 2, PNP – downstream CLIP)
		6	GND	
		7, 8	External RESET button connector	
		9, 10	External SWING AWAY button connector	
	SYNC connector	11	RX+	(SYNC IN)
		12	RX-	
		13	TX+	(SYNC OUT)
		14	TX-	
		15, 16	Not used	
		17, 18, 19	Not used	
		20	NC	
"Transmitter"	Connection for detection coil: Transmitter	1	Transmitter connector	(PULSE) CLR
		2	not occupied	
		3	Transmitter earth	(GND) BLK
"Receiver"	Connection for detection coil: Receiver	1	Receiver connector 1	(REC +) CLR
		2	not occupied	
		3	Receiver connector 2	(REC -) BLK

5.2.3 Performance Data - connectors

Dry relay contacts	250VAC / 3A 120VDC / 3A
24V switching outputs	Maximum current load: 200 mA
Switching inputs	Connection of 'make contacts' against ⊥ or 24V, or PNP-outputs (NPN on request)

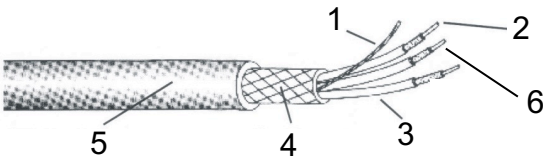
⚠	Switching elements (contactors, relays etc) may only be connected to the potential-free contacts if interference is suppressed.
⚠	The following procedures must be carried out by qualified personnel. Before removing cover plates etc make sure the equipment is isolated from mains or external voltage.

5.2.4 Mains supply to the control unit

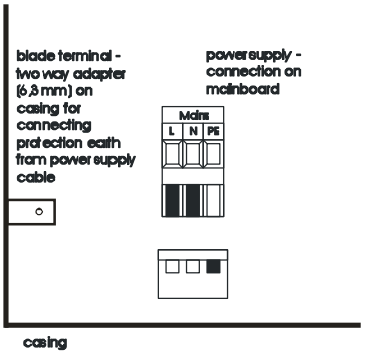
The machine is set up for U_{IN} = 100V~ … 240V~ and for a mains frequency of 50Hz … 60Hz.

ℹ	The main cable is a special EMC protected cable and should not be replaced by any other cable. If the mains plug is not being used, a connection box must be used instead.
⚠	Before connecting the mains cable ensure that the mains cable is unplugged.

5.2.4.1 Connecting the mains cable to the control unit



1 Shield
2 Conductor
3 Zero conductor
4 Isolation
5 PVC - Covering
6 Grounding conductor

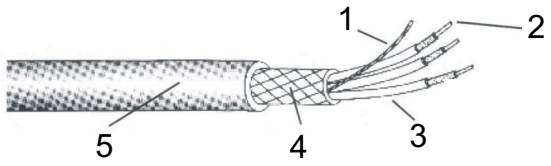


1. Strip insulation from cable covering (5) and leads (2,3,6) and attach cable cores (without equipment grounding conductor)
2. Equipment grounding conductor (6) must be supplied with a 6.3mm flat connection (cross-section up to 0.8mm^2)
3. For this purpose, a flat connection double connector is located on the housing to which the equipment grounding conductor is to be attached. On the two-way adapter is equipment grounding conductor connector which leads to the mains plug (Mains) on the main board.
4. Conductor (2) must be connected directly to the mains plug (L)
5. Zero conductor (3) must be connected directly to the mains plug (N)
6. Shield (1) and isolation (4) must be connected to the housing via the corresponding protective gland.
7. The outer covering (5) of the mains cable must be fed through the protective gland in such a way as to create strain relief.
8. Connect the cable with mains plug to an existing socket.

5.2.4.2 Connection via terminal box

1. Remove mains plug.
2. Strip 50mm length of insulation from cable and 10m from leads and attach cable cores.

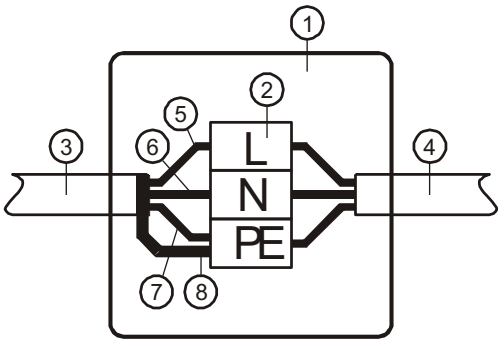
Mains cable



1 Shield
2 Conductor
3 PVC - Insulation
4 Isolation
5 PVC - Covering

3. Feed cable into connection box according to diagram below.

Make sure that the mains supply is switched off.



1	Terminal box	
2	3 pin terminal	
3	Control unit mains cable	
4	Mains supply	
5	Conductor L (brown)	to terminal L
6	Conductor N (blue)	to terminal N
7	Conductor PE (yellow/green)	to terminal PE
8	Shield	to terminal PE

IMPORTANT!!! **Shield to PE**

4. Close the terminal box.

Note:

The mains cable should have a wire cross-section of at least 0.75 mm². The main supply fuse protection should be set accordingly. The SMART-100 control unit contains mains fuse.

5.2.5 Behaviour of machine at start up

Lamps and outputs during start-up phase:

Output	Contact status
Green light	Illuminated
Red light	Off
Yellow light	Off
Metal relay 1 – Direct Out	Contacts 31 and 32 closed (consistent with no metal alarm)
Fault relay	Contacts 21 and 24 closed (consistent with no fault status)
Metal relay 2 – Timed Out	Contacts 11 and 12 closed (consistent with no metal alarm)

Lamps and outputs after start-up phase:

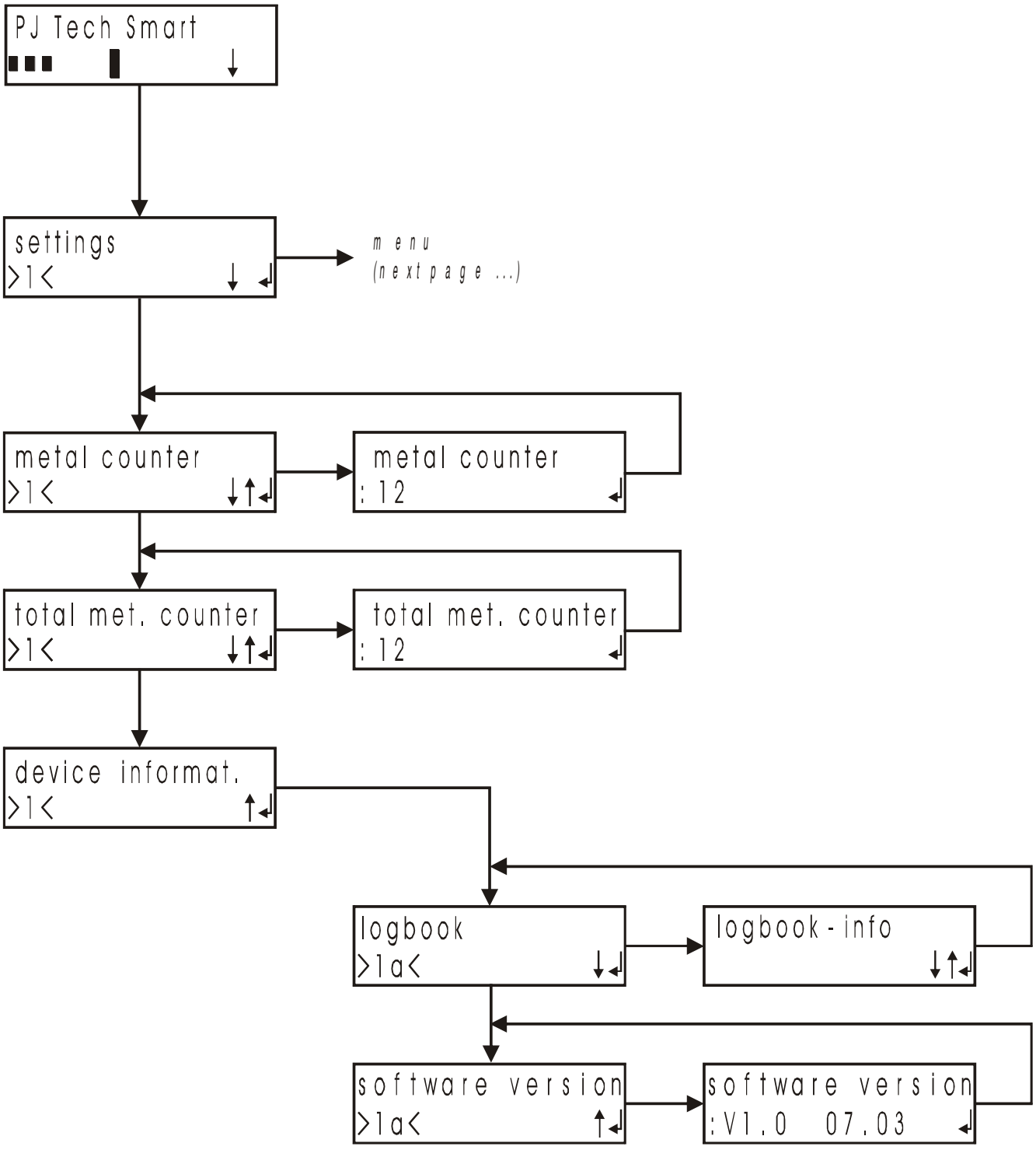
Output	Contact status
Green light	Illuminated
Red light	Off
Yellow light	Off
Metal relay 1 – Direct Out	Contacts 31 and 34 closed (when metal is detected)
Fault relay	Contacts 21 and 22 closed (when fault detected)
Metal relay 2 – Timed Out	Contacts 11 and 14 closed (when metal is detected)

After approximately 8 seconds the SMART-100 is ready for operation, i.e. the display shows the operating screen.

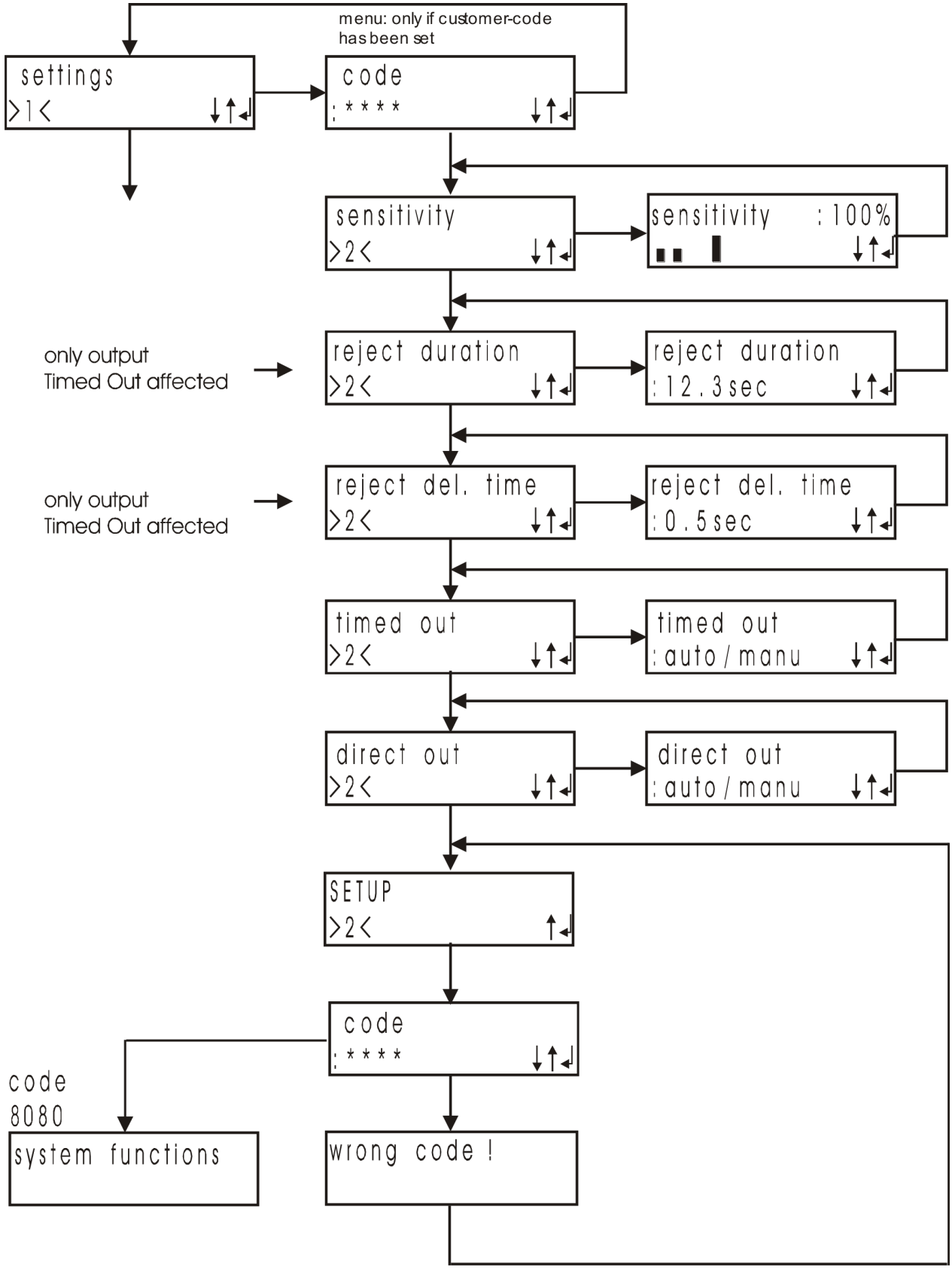
6 Menu tree

6.1 Main menu (Operator level 1)

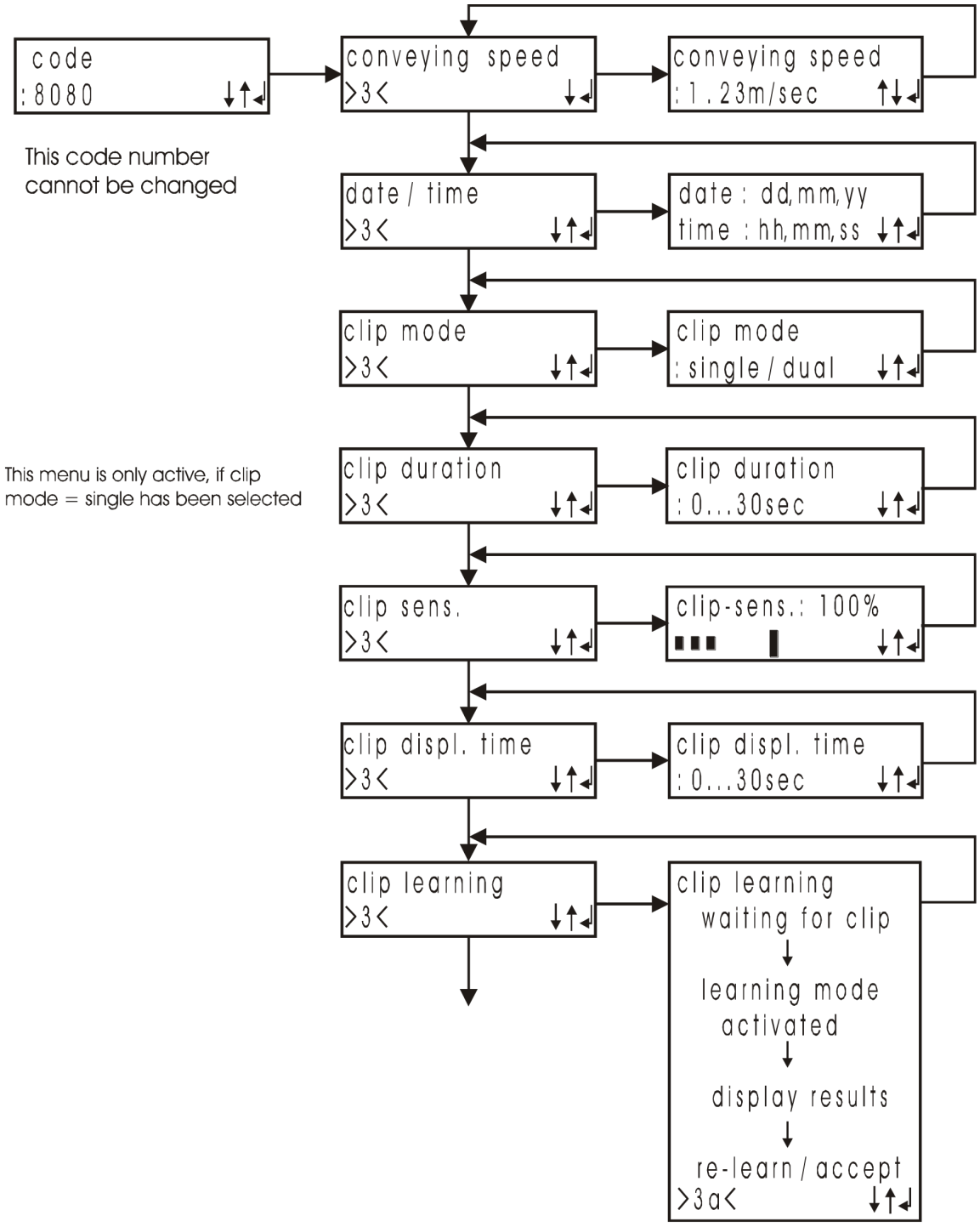
Operating screen

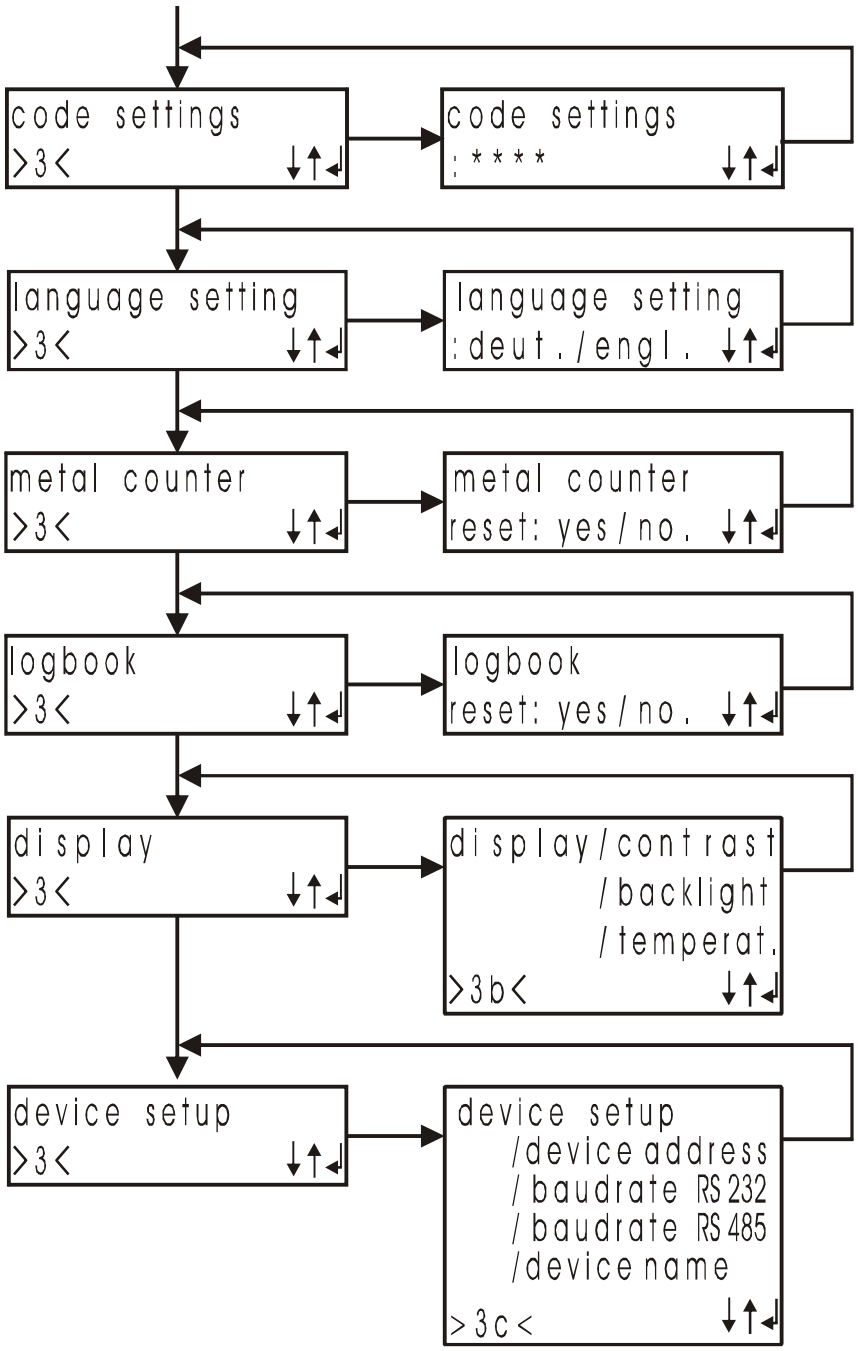


6.2 Menu tree / Settings menu (Operator level 2)



6.3 Menu tree / System functions (Operator level 3)




code settings
>3<
code settings
: ****
language setting
>3<
language setting
: deut./engl.
metal counter
>3<
metal counter
reset: yes/no.
logbook
>3<
logbook
reset: yes/no.
display
>3<
display/contrast
/backlight
/temperat.
>3b<
device setup
>3<
device setup
/device address
/baudrate RS232
/baudrate RS485
/device name
>3c<

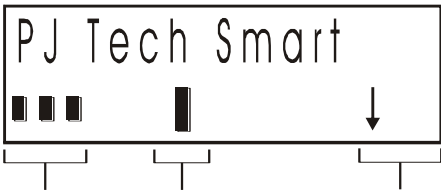
7 Operation

General advice for operation

- To operate the SMART-100 use the **UP**, **DOWN**, Confirm ↵ and **ESC** keys.
- The key symbols displayed show that changes can be made in the choice of screen and also in value setting.
- The **ESC** key returns the operator from any settings screen to the main screen.
- By pressing the **Reset/Test** key the operator resets the machine manually after a metal event.
- If no further action is taken the program automatically returns to the main screen after 30 seconds.

Display screens

1. Operating screen: is shown on the display during normal operation. Two (2) different operating screens can be set. Change operating screen by holding down the **ESC** key, at the same time pressing the **UP** key.



Example of operating screen

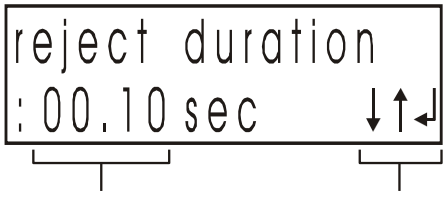
Bar for metal signal | Metal threshold | Display area for keys

2. Menu selection: use the **UP / DOWN** keys to move to the desired menu, then use the ↵ key to select that menu.

Operator level display | Display area for keys

Main menu	Operator level	> 1 <	> 1a <
Settings	Operator level	> 2 <	
Set up	Operator level	> 3 <	> 3a < > 3b < > 3c <

3. Settings screen: Use the **UP / DOWN** keys to change the setting or value. Changes are confirmed by pressing ↵. If after making changes only the **ESC** key is pressed, the old settings will remain.



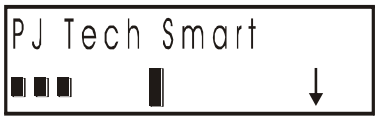
Example of a settings screen

Value | Display area for keys

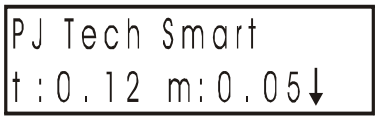
7.1 Main menu

7.1.1 Operating screen

is shown on the display during normal operation. Two (2) different operating screens can be set. Change the operating screen by holding down the ESC key, at the same time pressing the UP key.



Operating screen 1:
Information shown — Product for SMART-100
Metal signal as bar



Operating screen 2:
Information shown — Product for SMART-100
t: threshold
m: Metal signal

	If metal is detected the metal signal with the maximum value will be retained momentarily and displayed as a bar or a reading (e.g.: m: 0.8). If a clip is detected the message >> CLIP MODE << appears. The system will adjust itself to the previously set clip sensitivity. If metal is detected the metal signal with the maximum value will be retained momentarily and displayed as a bar or a reading (e.g.: m: 0.8) If bulk goods drive against the transmitter coil the message >> SWING AWAY << appears on the display and metal detection is switched off. If excess voltage is detected by the signal analyser the message >> SURGE << appears and metal detection is switched off.

7.1.2 Settings

Pressing the ↵ button selects the submenu **"Settings"**
Further submenus are explained below.

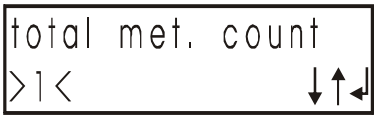
7.1.3 Metal Counter

Pressing the ↲ button selects the submenu **"Metal counter"**.

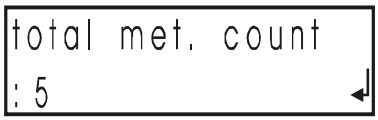
This displays the number of metal events. Pressing the >> RESET << button resets the metal counter.

Note: The value is automatically saved when the machine is switched off.

7.1.4 Total Metal Counter



Pressing the ↲ button selects the submenu "**Total metal counter"**.



This displays the total number of metal events. The total metal counter is reset by pressing >> RESET << for longer than 5 seconds.

Note: The value is automatically saved when the machine is switched off.

7.1.5 Device information

Pressing the ↲ button selects the submenu **"Device information"**.
Further submenus are explained below.

7.2 Settings Menu

7.2.1 Code

If customer code has been set, enter CODE
(if customer code not set, this screen will not appear)

7.2.2 Sensitivity

Pressing the ↵ key selects the submenu **"Settings"**. This is where scanning sensitivity for the current product is set or adjusted.

Sensitivity can be adjusted between 1 and 100% using the **UP** / **DOWN** keys. Press ↵ to confirm the set value.
Metal signal is shown as a bar, overview of sensitivity setting.

7.2.3 Reject Duration

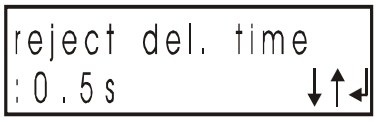
Pressing the ↵ key selects the submenu **"Reject duration"**. This is for setting and adjusting the activity duration of the switching outputs.

Reject duration can be adjusted between **0.05** seconds and **30.0** seconds using the **UP** / **DOWN** keys. Press ↵ to confirm the set value. This value is not relevant if manual reset mode is selected.

Note: This submenu affects only the relay output >> Timed Out <<.
If the Timed Out output is set to manual this submenu will not appear.

7.2.4 Reject Delay Time

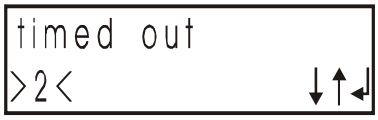
Pressing the ↵ key selects the submenu **"reject delay time"**. This is for setting and adjusting the time or distance between metal detection and activation of the switching outputs.



Reject delay can be adjusted between **0.00** seconds and **30.0** seconds using the **UP** / **DOWN** keys. Press ↵ to confirm the set value.

Note: This submenu affects only the relay output >> Timed Out <<.

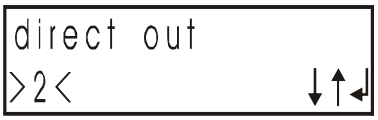
7.2.5 Timed Out



Pressing the ↵ key selects the submenu **"Timed out"**. This position determines whether the metal outputs should be reset manually or automatically (after preset reject duration).

Use the **UP** / **DOWN** keys to select the type of RESET: **"AUTO"** or **"MANUAL".** Use the ↵ key to confirm the setting.

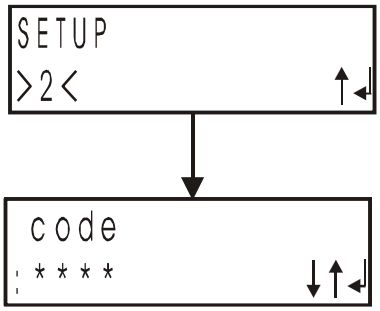
7.2.6 Direct Out



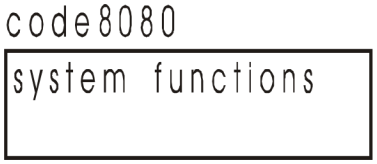
Pressing the ↵ key selects the submenu **"Direct out"**. This position determines whether the metal outputs should be reset manually or automatically (with fixed setting of reject duration of 0.5 secs).

Use the **UP** / **DOWN** keys to select the type of RESET: **"AUTO"** or **"MANUAL".** Use the ↵ key to confirm the setting.

7.2.7 Set up

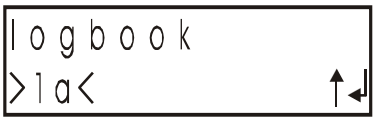


Pressing the ↵ key selects the submenu **"Setup".**
Entering pre-determined, fixed code numbers allows access to other settings menus.
Code no.: 8080, Operator level 3, System functions



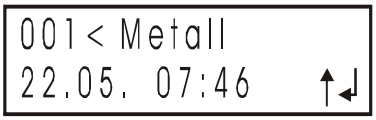
7.3 Device information menu

7.3.1 Logbook



Pressing the ↵ key selects the submenu "**Logbook"**. Generally 2 screens (2 pages) are used for creating entries in the logbook.

Example 1: Metal alarm



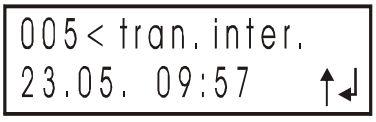
Screen 1: Message text for metal alarm:

001<	Entry number, example no: 001
Metal	Message text
22.05. 07:46	Date and time of event
	Press **UP** key to move to screen 2

Screen 2: Information about message text:
Information and tips relating to message text on screen 1 are shown here,

001<	Entry number (example no: 001)
Signal	1.Parameter: Signal strength with 0.35V [V_{SS}]
MCnt	2.Parameter: Metal count: 9. Metal event
	Press **UP** key to move to next screen or **DOWN** key to change to previous menu

Example 2: Error message



Screen 1: Message text for error message:

005<	Entry number, example no: 005
tran. inter.	Message text: Transmitter break in connection
23.05. 09:57	Date and time of event
	Press **UP** key to move to next screen
	Press **DOWN** key to move to next screen

Screen 2: Information about error message:
Information and tips relating to error text on screen 1 are shown here,

005<	Entry number (example no: 005)
- - -	1.Parameter: - - - (no other parameters available)
	2.Parameter:
	Press **UP** key to move to next screen or **DOWN** key to change to previous menu

This message appears when there is no entry in the logbook or the logbook has been "emptied" using the reset function in the "System functions" menu.

Examples of logbook entries:

Screen 1 Line 1	**Screen 1 Line 2** Day. Month. Hour.: Minute	**Screen 2 Line 1**	**Screen 2 Line 2**	**Explanation**
power off	10.10 13:13	- - -	- - -	Machine switched off
power on	xx.xx xx:xx	- - -	- - -	Machine switched on
swing away	xx.xx xx:xx	- - -	- - -	Sensor 3 (transmitter coil swing away)
sys-disable	xx.xx xx:xx	- - -	- - -	System disabled – excess voltage detected
metal	xx.xx xx:xx	Sig: x.xx	MCnt: xxx	Metal alarm Sig: Metal signal [Vss] MCnt: Current metal count
clip dur	xx.xx xx:xx	- - -	- - -	Learnt with metal: Clip not detected by coil
clip sensor	xx.xx xx:xx	- - -	- - -	Sensor 1 / 2 (Signal duration too long)
sw aw-dur.	xx.xx xx:xx	- - -	- - -	Sensor 3 (transmitter coil swung away for longer than 1 min.)
+24V faulty	xx.xx xx:xx	- - -	- - -	Power supply +24V faulty
+24V ampl.	xx.xx xx:xx	- - -	- - -	Power supply +24V output stage faulty
-24V faulty	xx.xx xx:xx	- - -	- - -	Power supply -24V faulty
-24V ampl.	xx.xx xx:xx	- - -	- - -	Power supply -24V output stage faulty
tran. overl.	xx.xx xx:xx	- - -	- - -	Transmitter overloaded
tran. inter.	xx.xx xx:xx	- - -	- - -	Transmitter break in connection
tran.volt.	xx.xx xx:xx	- - -	- - -	Transmitter voltage above max set transmitter voltage
no signal	xx.xx xx:xx	- - -	- - -	After switching on: no signal available
rec. inter.	xx.xx xx:xx	- - -	- - -	Receiver break in connection
wrong anal.	xx.xx xx:xx	- - -	- - -	Wrong signal analyser set in menu or plugged into the board

Max number of logbook entries with SMART-100 interface module: (Option)

999 entries (permanent)

Max number of logbook entries without interface module: (Standard)

100 entries (non-permanent, network standard time: 1.1.2000 00:00:00)

7.3.2 Software Version

Press ↵ to select submenu "**Software Version"**. This displays the current software version.

This displays the current software version.
↵ closes the screen.

7.4 Menu System Functions (via code 8080)

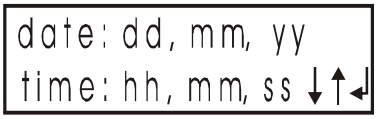
7.4.1 Conveying speed

Pressing the ↵ key selects the submenu **"Conveying speed"**.

Conveying speed can be adjusted between 0.05m/sec and 15m/sec using the **UP** / **DOWN** keys. Press ↵ to confirm the set value.

7.4.2 Date / time

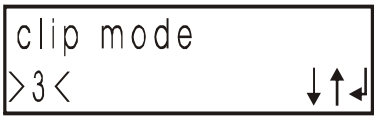
Press ↵ to select the submenu **"Date / Time"**.



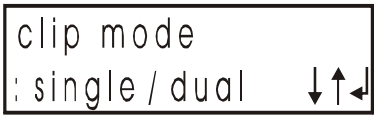
Use the **Down** key to select the year (yy) first. Press ↵ to change to month (mm) and day (dd). After, set hours (hh), minutes (mm) and seconds (ss). Change the values by pressing the **UP** or **DOWN** keys

Press ↵ at the end to confirm date and time setting.

7.4.3 Clip Mode



Press ↵ to select submenu **"Clip Mode"**.

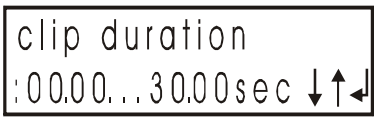


Use **UP / DOWN** keys to switch between clip mode single or clip mode dual. Use the ↵ key to confirm the setting.

Note: Clip mode SINGLE means that only one initiator is available to switch the system to lower sensitivity
Clip mode DUAL means that two initiators are available:
the first initiator switches the system to lower sensitivity,
the second initiator recreates the sensitivity for normal system operation.

7.4.4 Clip Duration

Press ↵ to select submenu **“Clip Duration“**.



A value between 0 and 30 seconds can be set using the **UP** / **DOWN** keys. Use the ↵ key to confirm the setting.

Note: This submenu will only be displayed in SINGLE clip mode.
Clip duration means: The system is operated with the clip sensitivity setting for the clip duration which is set here. After this time has elapsed the sensitivity for normal system operation is automatically resumed.

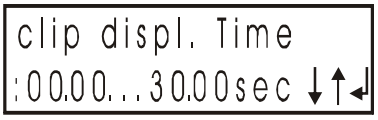
7.4.5 Clip sensitivity

Press ↵ to select the submenu **”Clip sensitivity“**.

Clip sensitivity can be adjusted between 1 and 100% using the **UP** / **DOWN** keys.
Press ↵ to confirm the set value.
Metal signal is shown as a bar, overview of sensitivity setting.

7.4.6 Clip Display

Press ↵ to select submenu **“Clip Display“**.



A value between 0 and 30 seconds can be set using the **UP** / **DOWN** keys. Here the operator can enter a time between 0 and 30 seconds for the duration of the text display
>> CLIP-MODE << (reduced sensitivity).
Use the ↵ key to confirm the setting.

Note: This submenu will only be displayed in SINGLE clip mode.
If the set clip duration is shorter than the selected clip display duration, the message >> CLIP MODE<< will appear for as long as the selected display duration

7.4.7 Clip learning

Press ↵ to select submenu **“Clip learning“**.
Select ↵ to move to next submenu >> waiting for clip <<.

7.4.7.1 Waiting for clip

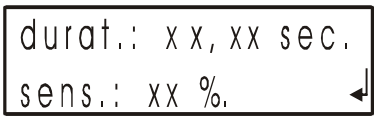
Press ↵ to select submenu **“Waiting for clip“**.
Select ↵ to move to next submenu >> learning mode activated <<.

7.4.7.2 Learning mode activated

Press ↵ to select the submenu **“Learning mode activated“**.

The learning mode is automatically activated when the connected initiator detects a > Clip <:
the following are measured automatically:
1.) Clip Duration: Time from detection of clip until clip has passed the coil.
2.) Clip sensitvity: Reduced value for sensitivity of the system during clip phase, so that this clip is not detected by the coil as metal.

7.4.7.3 Display: received values



This menu is displayed automatically after a learning process.
It shows the measured time: Clip Duration [in sec]
and measured sensitivity: Clip sensitvity [in %]

Note:	In clip mode:	is displayed:
	SINGLE:	Duration [in sec] and sensitivity [in %]
	DUAL:	only sensitivity [in %]

7.4.7.4 Display: relearn or accept values

This menu **“Re-learn or accept“** is displayed after the received values are shown.
Press the ESC key to start the learning process again
(Menu selection: >> Waiting for clip <<).
Press ↵ to accept the learned values.

7.4.8 Code settings

Press ↵ to select submenu **"Code Settings"**. A four character code for the settings screen can be entered here.

Use the **UP / DOWN** keys to select the numbers. Pressing ↵ confirms the selected letter, number or symbol and the cursor then moves to the next position. After the fourth cursor position pressing ↵ accepts the new code.

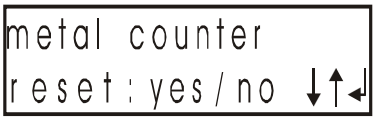
7.4.9 Language setting

Press ↵ to select the submenu **"Language setting"**. This is for setting the appropriate language for the country of operation.

Use the **UP / DOWN** keys to select the appropriate language. Use the ↵ key to confirm the setting.

7.4.10 Reset metal counter

Press ↵ to select the submenu **"Metal counter"**. This resets both metal counters in the main menu
(> Metal count < and > Total metal count <).



Use the **DOWN** key to activate reset. Use the ↵ key to make a selection.

7.4.11 Reset Logbook

Press ↵ to select the submenu "**Logbook"**. The logbook can be reset in > Main menu / Machine Information <.

Use the **DOWN** key to activate reset. Use the ↵ key to make a selection.

7.4.12 Display

Press ↵ to select the submenu **"Display"**. This is where various display parameters are adjusted.

7.4.12.1 Display contrast

Press ↵ to select the submenu **"Display Contrast"**. This is where the contrast of the display screen is adjusted.

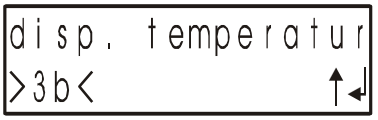
Use the **UP / Down** keys to adjust the display contract between 0 and 99. Use the ↵ key to confirm the setting. The contrast values provide a guide only, fine-tuning may be necessary to improve legibility of the characters.

7.4.12.2 Display backlight

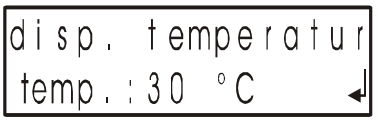
Press ↵ to select the submenu **"Display backligh"**.

Use the **UP / DOWN** keys to set backlighting to always on or intermittent. Intermittent mode means that the backlight will remain on for approx 30 seconds once the key is pressed.
Use the ↵ key to confirm the setting.

7.4.12.3 Display temperature



Press ↵ to select the submenu **"Display temperature"**.

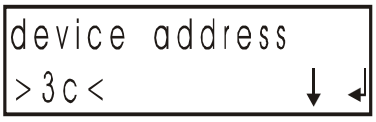


The temperature shown refers to temperature inside the housing or on the display. Necessary for adjusting automatic display contrast.

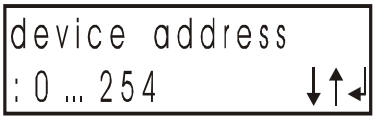
7.4.13 Machine settings

Press ↵ to select the submenu **"Machine settings"**. This is where various machine parameters are adjusted.

7.4.13.1 Device address



Press ↵ to select the submenu **"Device address"**. This is where the machine address is set.



Use the **UP / Down** keys to set the machine address between 0 and 254. Use the ↵ key to confirm the setting.

7.4.13.2 Baud rate RS232

Press ↵ to select the submenu **"Baud rate RS232"**. This is where the transfer rate of the RS232 serial interface is adjusted.

Use the **UP / DOWN** keys to choose between the following baud rates: 9600, 19200, 38400, 57600, 115200 Baud
Use the ↵ key to confirm the setting.

7.4.13.3 Baud rate RS485

Press ↵ to select the submenu **"Baud rate RS485"**. This is where the transfer rate of the RS485 serial interface is adjusted.

Use the **UP / DOWN** keys to choose between the following baud rates: 9600, 19200, 38400, 57600, 115200 Baud
Use the ↵ key to confirm the setting.

7.4.13.4 Device name

Press ↵ to select the submenu **"Device name"**. This is where a 10 character name for the machine can be entered.

Use the **UP / DOWN** keys to enter the appropriate letters. Use ↵ to move to the next letter. Finally, select ↵ to confirm the setting.

The process is the same for all submenu selections. Select **ESC** to leave the submenu and access the **Operator level 3, system functions**. Use **ESC** to return to the main screen (this is the same for leaving all main operator levels).

8 Errors and Fault Rectification

If you have any questions, please state the equipment type and serial number!

8.1 Error messages

When an error message is detected the red “Fault“ LED on the operator panel flashes and the fault relay trips out. The appropriate error will be shown on screen.

8.1.1 Transmitter monitoring – Part 1

This message is displayed if the transmitter signal is not detected or the connection to the detector is broken.

Error message	Possible causes	Action
transmitter overloaded! ↵	Transmitter cable to detection coil (or transmitter coil within detector) has short circuit.	Disconnect transmitter cable at the detector (triax cable) and measure with Ohm meter: replace if necessary.

Error message	Possible causes	Action
transm. connect. interrupted! ↵	Transmitter cable to detection coil (or transmitter coil within head) is interrupted.	Check transmitter cable for breaks and renew if necessary. Check transmitter cable plug and socket connections, remove and reinsert if necessary.

8.1.2 Transmitter monitoring – Part 2

This message is displayed when the transmitter signal from the detection head exceeds the set threshold value (max transmitter voltage).

Error message	Possible causes	Action
transmitter - voltage? ↵	Transmitter pulse duration is too long or frequency too low or selected threshold >> Max transmitter voltage << is too low	In >> System Parameters << menu correct Start Transmit and End Transmit or correct frequency or adjust >>Max transmitter voltage <<

8.1.3 Monitoring of the receiver

This message is displayed when the connection to the receiver coil is interrupted.

Error message	Possible causes	Action
connection to detection coil? ↵	Receiver cable to detection coil (or receiver coil within head) is interrupted.	Check receiver cable for breaks and renew if necessary. Check receiver cable plug and socket connections, remove and reinsert if necessary.

8.1.4 Monitoring of positive operating voltage

This message is displayed when operating voltage (+ 24V) is faulty

Error message	Possible causes	Action
power supply +24V faulty ↵	Power supply +24V faulty Power supply (AC-DC converter) defective	Check power supply and measure with voltmeter if necessary

8.1.5 Monitoring of output transformer at positive operating voltage

This message is displayed when the output transformer (at +24V) is overloaded

Error message	Possible causes	Action
power supply +24V to ampl.? ↵	PTC (R105) high resistance or defective T103 has short circuit	Check transmitter level, check pulse duration, measure with voltmeter or oscilloscope

8.1.6 Monitoring of negative operating voltage

This message is displayed when power supply (-24V) is faulty

Error message	Possible causes	Action
power supply -24V faulty ↵	Power supply -24V faulty Power supply (AC-DC converter) defective	Check power supply and measure with voltmeter if necessary

8.1.7 Monitoring of output transformer at negative operating voltage

This message is displayed when the output transformer (at -24V) is overloaded

Error message	Possible causes	Action
power supply -24V to ampl.? ↵	PTC (R118) high resistance or defective T107 has short circuit	Check transmitter level, check pulse duration, measure with voltmeter or oscilloscope

8.1.8 Monitoring of Swing Away sensor

Note: Functionality is available only if in >> Options << menu the function as Swing Away sensor is allocated to Sensor 3.
The message is displayed when the transmitter coil is swung away and a sensor is available
The sensor must deliver a signal for 60 seconds in order to provoke an error message

Error message	Possible causes	Action
swing-away dur. exceeded 60 sec. ↵	Transmitter coil folded back > Swing Away < sensor defective	Fold back transmitter coil, check sensor and measure sensor signal with voltmeter

8.1.9 Monitoring of signal analyser

This message is displayed when the signal analyser plugged into the main board is different to that set up in the menu

Error message	Possible causes	Action
wrong signal- analyzer ↵	Signal analyser plugged into main board is not the same as selected in menu	Change signal analyser in the main board or select different signal analyser in menu (system parameters)

8.1.10 Monitoring of clip sensors

This message is displayed when a clip sensor delivers a signal for longer than 10 seconds

Error message	Possible causes	Action
clip-head fault ↵	A clip sensor is defective. Clip remains above sensor as a result of belt stop	Inspect clip sensors, check if sensor is faulty (constant LOW level) or if clip is above sensor

8.1.11 Monitoring of clip (Menu: c lip learning)

This message is displayed only in >> Clip learning << menu when clip requires more than 15 seconds to be detected by coil

Error message	Possible causes	Action
clip-duration exceeded 10sec. ↵	Clip stays where it is as a result of belt stop	Check belt running

8.2 Undefined activation of switching outputs

Possible causes	Action
Machine incorrectly installed	See “Assembly”
Conveyor belt systems: Certain parts of the conveyor belt are conductive: • Contaminated with metal (welding spatter, metal chips, abraded material….) • Belt junction causing metal alarm to signal even when no product on moving conveyor	Clean conveyor belt of all residue. If necessary, replace conveyor belt.
Sensitivity setting too high	If necessary, reduce sensitivity manually.
Metal particles hard to identify due to corrosion or encapsulation	Check processed material carefully, if necessary, pass through detector again.
Loose contact at the detector cables	Check connections
Material or conveyor statically charged (cracking sound heard at the detection coil)	Prevent static by additional earthing (please consult PJ TECH) or by using ion spraying devices.

8.3 Replacing electronic boards

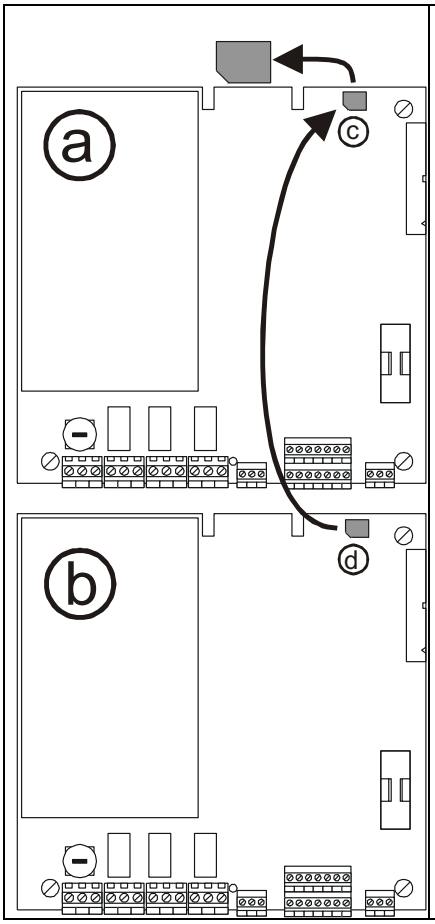
The SMART-100 control unit consists of 3 electronic boards, **Evaluation electronics** (see illustration 8.3.2, point 3), the der **Signal analyser - board** (see illustration 8.3.2, point 5) and the **Display board** (see illustration 8.3.3, Point 8).

8.3.1 Replacing evaluation electronics board (with mounting plate)

1. Illustration: see 8.3.2
2. Disconnect mains supply and external circuits and open cover of electronics housing
3. Remove connectors (1) and (6) and remove fastening screws (2)
4. Remove mounting plate with evaluation electronics (3)
5. Install the new board in reverse order but **do not connect to mains power supply!**

The SMART-100 electronics are equipped with a memory module which contains all the equipment settings and product data. If this memory board is transferred to the new controller board no new settings need to be programmed.

Replacing the data memory:



a: New controller board

b: Old controller board

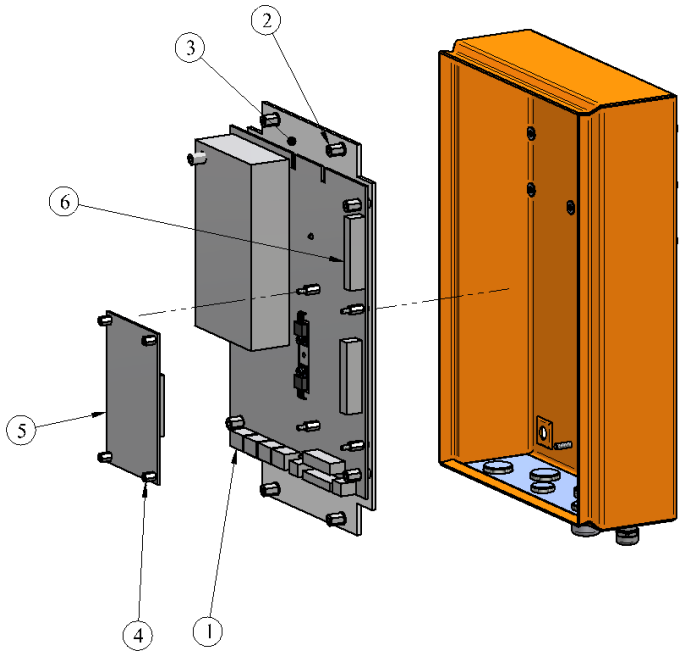
c, d: Device and program memory

Procedure:

1. Remove data memory c) from the new (already installed) controller board a) and put to one side.
2. Remove data memory d) from the old controller board b) and plug it carefully into the new controller board a).
3. Ensure that the clipped corner on the memory device points to the left.
4. Switch on power supply. The new board runs with the “old” parameters.

8.3.2 Replacing signal analyser board

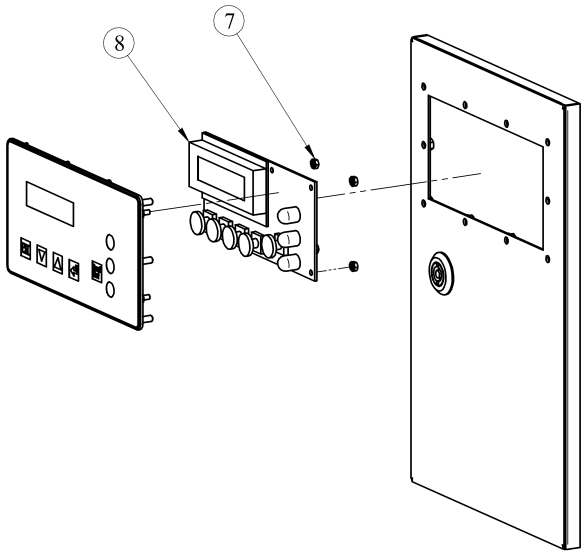
1. Remove power supply and open cover of electronics housing
2. Undo fixing screws (4).
3. Remove signal analyser board (5)
4. Install the new receiver board in reverse order.



Note: An adapter board (with signal analyser module) can be plugged in, in place of a signal analyser board

8.3.3 Replacing display board

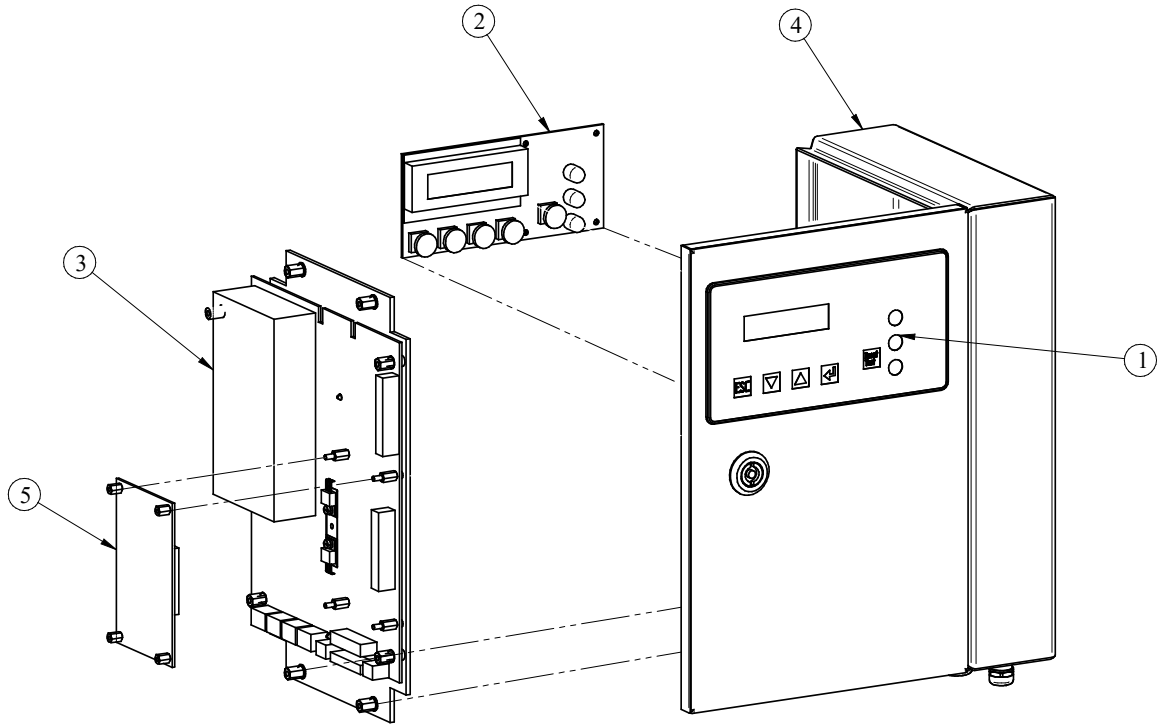
1. Remove power supply and open cover of electronics housing
2. Remove connectors (see illustration 8.3.2, point 6) and remove fastening screws (7)
3. Remove display board (8)
4. Install the new display board in reverse order.



9 Spare parts, Servicing

Please state type of equipment and serial number when contacting us.

9.1 Spare parts drawing SMART-100 standard version



9.2 Spare parts list SMART-100 standard version

Item No.	Part	Item No.	Remarks Drawing no.
1	Display cover	SM100-CP-LCD-COV	Front plate
2	Display board	SM100-CP-LCD	
3+5	Evaluation electronics with mounting plate & Signal analyser electronics	SM100-CP-CU	
4	Elektronics housing	SM100-CP-BOX	
6	Signal analyser electronics adapter		Optional
7	Display ribbon cable		Not shown

9.3 Address for servicing

PJ TECH	
+27 (011) 704-7088/9 smart@pjtech.co.za www.pjtech.co.za	Northlands Business Park Northriding Johannesburg Republic of South Africa

10 Shipping, preservation, waste disposal, transport, storage

10.1 Shipping, preservation, waste disposal

1. Choose packing that is suitable for the type and size of unit, taking into account whether the shipment is for export by sea or airfreight, or for national or international road transport The packing material must protect the goods from all damage under normal transport conditions.

2. Depending on the size, weight and nature of the goods packing in cardboard boxes, boxed pallets etc is only suitable for road transport.
Use reinforced card, corrugated cardboard, blister packing and shredded paper to fill and protect the goods.
Electrostatic sensitive components (electronic boards, electronic modules, etc.) must be packed in antistatic foil or foil bags prior to packing!
(this is essential!)
Stick additional warning labels on the outside of the packaging e.g., “Attention, electronic equipment, do not drop”, etc. The packing should be sealed with adhesive tape and, where the weight exceeds 50kg, additionally with wrapping tape.

2a. When packing for international road transport use the instructions above (see point 2). Larger and heavier shipments must also be protected as for export in wooden crates. Care must be taken to ensure that the goods inside the packing are protected against corrosion.
Any parts that will corrode easily must be wrapped in oil paper or corrosion-protective foil. Care must be taken to prevent the components moving around within the packaging.

2b. International air freight shipments must be packed in wooden crates or on export pallets.
Care must be taken that the goods are secure and well-protected inside the packing. Any parts liable to corrode must be wrapped in oil paper, protective foil or sprayed with anti-corrosion spray.

2c. Sea-freight must be packed in seaworthy export crates. These crates can be obtained from specialist suppliers.
The crates must be lined with oil paper to make them resistant to sea water and prevent corrosion.
In addition, the goods must be protected against corrosion by use of a spray or be wrapping in protective foil.
Care must be taken to ensure that the goods cannot move around inside the crate.
After packing the sea-freight crates must be properly closed.
The sea crates must also be fastened externally with securing tapes.

During loading care must be taken not to damage the external packaging.
The carrier must certify that the shipment has been accepted and loaded correctly by detailing this on the bill of lading, loading list etc.

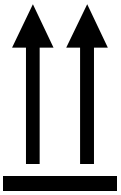
3. Waste disposal: Observe the national waste disposal regulations.

10.2 Shipping

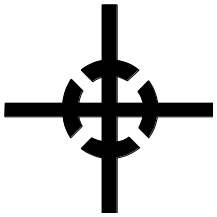
- Ensure the unit is transported with care to avoid endangering people and prevent damage to the machine. In addition to the following advice, local safety and accident prevention procedures must be observed.
- Note the following symbols for shipping and storage:

Keep dry

Glass - handle with care



Up



Centre of gravity

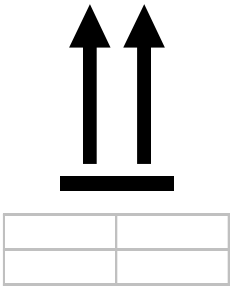
- Do not compress the side walls of the unit or any attached parts by pulling obliquely on ropes or chains.
- If any red transportation locks have been fitted either between moving parts or elsewhere on the unit, these must be removed prior to commissioning.
- Care must be taken to ensure that the equipment does not topple over or slide off loading areas.
- Any damage incurred in transit must be reported to the manufacturer.

10.3 Storage

- The equipment should be stored in an enclosed room until final assembly.
- If the equipment is to be stored outside it must be covered with tarpaulins and left open underneath so that any condensation can run off.
- Sea-freight shipments should not be opened or damaged during transport and storage. The equipment should rest on waterproof mats to prevent moisture from the ground penetrating the machinery.
- To ensure equipment is stored correctly please observe the following shipping and storage symbols

Keep dry

Glass – handle with care



Up

11 PJ Tech Other Systems