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SAMES  **KREMLIN**



User manual

”Turbine Control Rack” TCR Control Module



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The French version is deemed the official text and Sames will not be liable for the translations into other languages.

"Turbine Control Rack"

TCR

Control Module

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1. Regulations, Safety Rules and Warranty

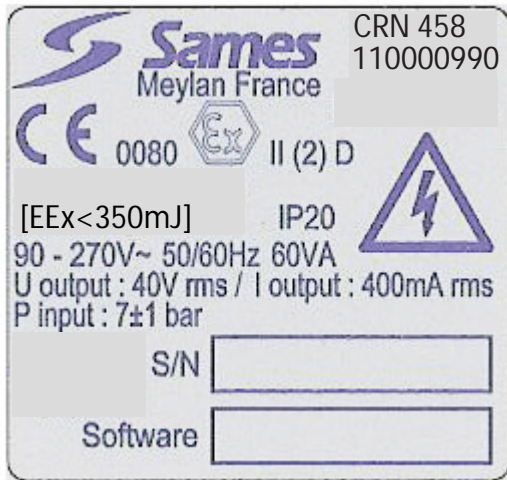
1.1. Safety Rules

This device may be dangerous if it is not used in compliance with the safety rules specified in this manual.

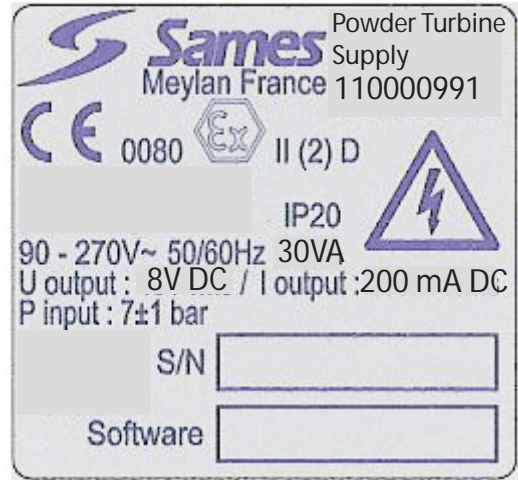
- The TCR control module must be installed away from explosion risk areas.
 - The electrostatic projection equipment must only be used by trained staff who have fully read and understood rules no°. 1 to 12 below:
- 1 A warning notice written in a language understood by the operator, summarizing safety regulations nos.° 2 to ° 9, in section 1.2 of this manual, must be placed in a clearly visible position close to the powder-projection booth.
 - 2 Shoes worn by operators must be antistatic and comply with the ISO 2251 standard. If gloves are worn, only anti-static gloves or gloves which provide operator grounding may be worn.
 - 3 The floor in the area in which the operator works must be anti-static (ordinary bare concrete floors are anti-static).
 - 4 Powder projection must be performed in front of a specially designed ventilated booth. Start-up of the TCR module must be interlocked with operation of the ventilation system.
 - 5 Skin contact or inhalation of products used with this equipment may be dangerous for personnel (cf. Material Safety Data Sheets of products used).
 - 6 All conducting structures such as floors, powder-projection booth walls, ceilings, barriers, parts to be painted, powder distribution tank, etc., that are in or near the work station and the earth terminal on the electro-pneumatic control module must be electrically connected to the ground system protecting the electrical power supply.
 - 7 Parts to be painted must have a ground resistance less than or equal to 1 MΩ.
 - 8 Powder-projection equipment must be maintained regularly according to the manufacturer's instructions. Repairs must be carried out in strict compliance with these instructions.
 - 9 Before cleaning the projector or carrying out any other work in the projection area, the high voltage power supply must be switched off in such a way that it cannot be switched back on.
 - 10 Only SAMES original spare parts guarantee operating safety of the equipment.
 - 11 The ambient temperature must be between 0 and 40°C.
 - 12 Switch off the TCR module electrical power supply before connecting the 'Inobell' projector
Before disconnecting the projector, switch off the CRN 458 power supply (to prevent operating faults).

1.2. Module identification plate

CRN 458



Powder Turbine Supply



1.3. Warranty



Warranty label

During the TCR command module warranty period, the removal or attempted removal or cutting of labels (located under the modules) is strictly forbidden, otherwise the warranty will no longer apply.

2. Presentation

The **TCR 'Turbine Control Rack'** control module is a complete control module capable of managing all powder projector functions. A single screen allows access to the different setting and display functions. It comprises a **'CRN 458'** module and a **'Powder Turbine Supply'** module.

The **CRN 458** module communicates with the **Powder Turbine Supply** module through an RS 485 serial link.

The **CRN 458** module controls the high voltage power and powder flow, while the **Powder Turbine Supply** module controls powder projector rotation, shaping air and bearing protection air.



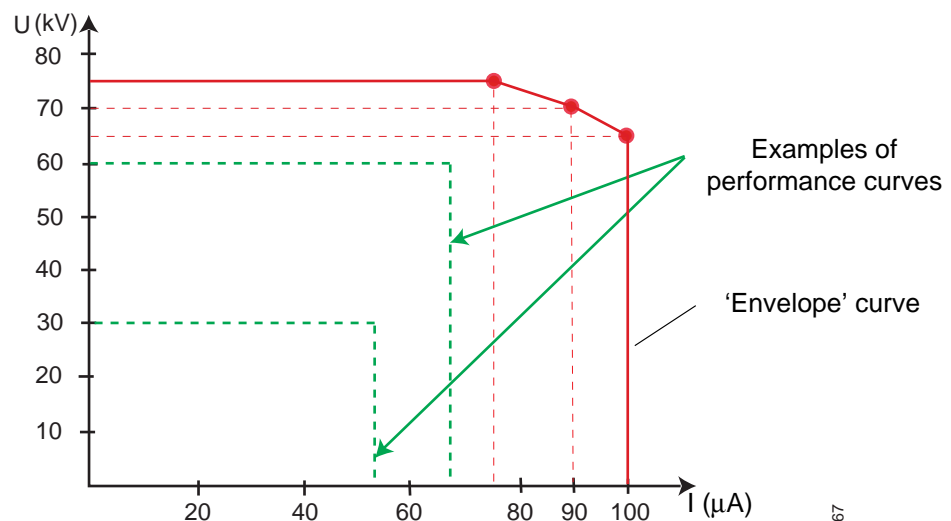
3. Characteristics

3.1. General electrical characteristics

CRN 458 control module	
Power supply voltage	90 to 270V AC
Frequency	50 - 60 Hz
Maximum power	60 VA
Maximum output voltage	40V effective (rms)
Maximum output current	400 mA effective (rms)

Powder Turbine Supply	
Power supply voltage	90 to 270 VAC
Frequency	50 - 60 Hz
Maximum power	30V.A
Maximum output voltage	8 V DC
Maximum output current	200 mA DC

Characteristics of projector output current



DES04467

3.2. General pneumatic characteristics

TCR module	
Input air pressure	6 bar min. - 8 bar max.
CRN 458 control module	
Maximum air consumption (injection and dilution) without increased flow kit	100 NI/min
Maximum air consumption (increased injection and dilution) with increased flow kit	130 NI/min
Powder Turbine Supply module	
Maximum air consumption	250 NI/min
Air flow required for bell cup rotation	Approximately 40 NI/min under stable conditions (regardless of speed setpoint)
	110 NI/min max. under transient acceleration conditions
Shaping air flow	0 to 80 NI/min (proportional from 0% to 100% of the setpoint)
Bearing protection air flow	60 NI/min

3.3. Compressed air quality

Required characteristics for compressed air supply according to standard NF ISO 8573-1:

Dew point at 6 bar (87 psi.)	Class 4, i.e. 3°C (37°F)
Maximum oil concentration	Class 1, i.e. 0.01 mg/m ₀ ³
Maximum particle size of solid contaminants	Class 3 i.e. 5 µm
Maximum concentration of solid contaminants	5 mg/m ₀ ³

Note: m₀³: values given for a temperature of 20°C (68°F), at an atmospheric pressure of 1013 mbar.



WARNING : Non-compliance with these characteristics may lead to malfunction of the 'TCR' control module.



WARNING : A 5µfilter must be installed upstream of the "TCR" control module compressed air supply system. The size of this filter depends on the size of the installation. If equipment is damaged due to the use of contaminated air, the warranty shall be invalid.

4. Operation

The **Inobell** projector is connected to the **TCR 'Turbine Control Rack'** control module, which is a dual control module containing a '**CRN 458**' module and a '**Powder Turbine Supply**' module.

The **CRN 458** module communicates with the **Powder Turbine Supply** module through an RS 485 serial link.

The **CRN 458** module controls the high voltage power and powder flow, while the **Powder Turbine Supply** module controls powder projector rotation, shaping air and bearing protection air.

The **TCR** control module can operate in either local or remote mode through a serial link:

- **In local mode (screen and cabled trigger):** the operator can access the different module screens which allow him to adjust settings and the display, and to monitor powder flow, the high voltage projector current, rotation speed and shaping air.

Methods for changing or adjusting settings are described in the following chapters.

Note: if a PLC is connected to the control module, the operator has 10 seconds to take control of local mode on display of screen '**A0**'. Press any key in screen '**A0**' once every minute in order to maintain local mode.

- **In Serial Link Mode:** the operator can only view settings.

The **TCR** control module is monitored using an RS 485 serial link connected to the PLC link connector.

When the **TCR** module is switched on, the **CRN 458** module is set to search for the '**Powder Turbine Supply**' module:

- If the **CRN 458** module does not detect any dialogue with the second module, it displays the no 'Powder Turbine Supply' module fault.
- If the **CRN 458** module does not detect the powder projector (low voltage connector disconnected) it displays the 'No HV connection' fault.
- If the '**Powder Turbine Supply**' module does not detect the turbine (speed detector connector, no signal), the CRN 458 module displays the 'No speed signal' fault.

In addition, on first use, the following settings must be entered.

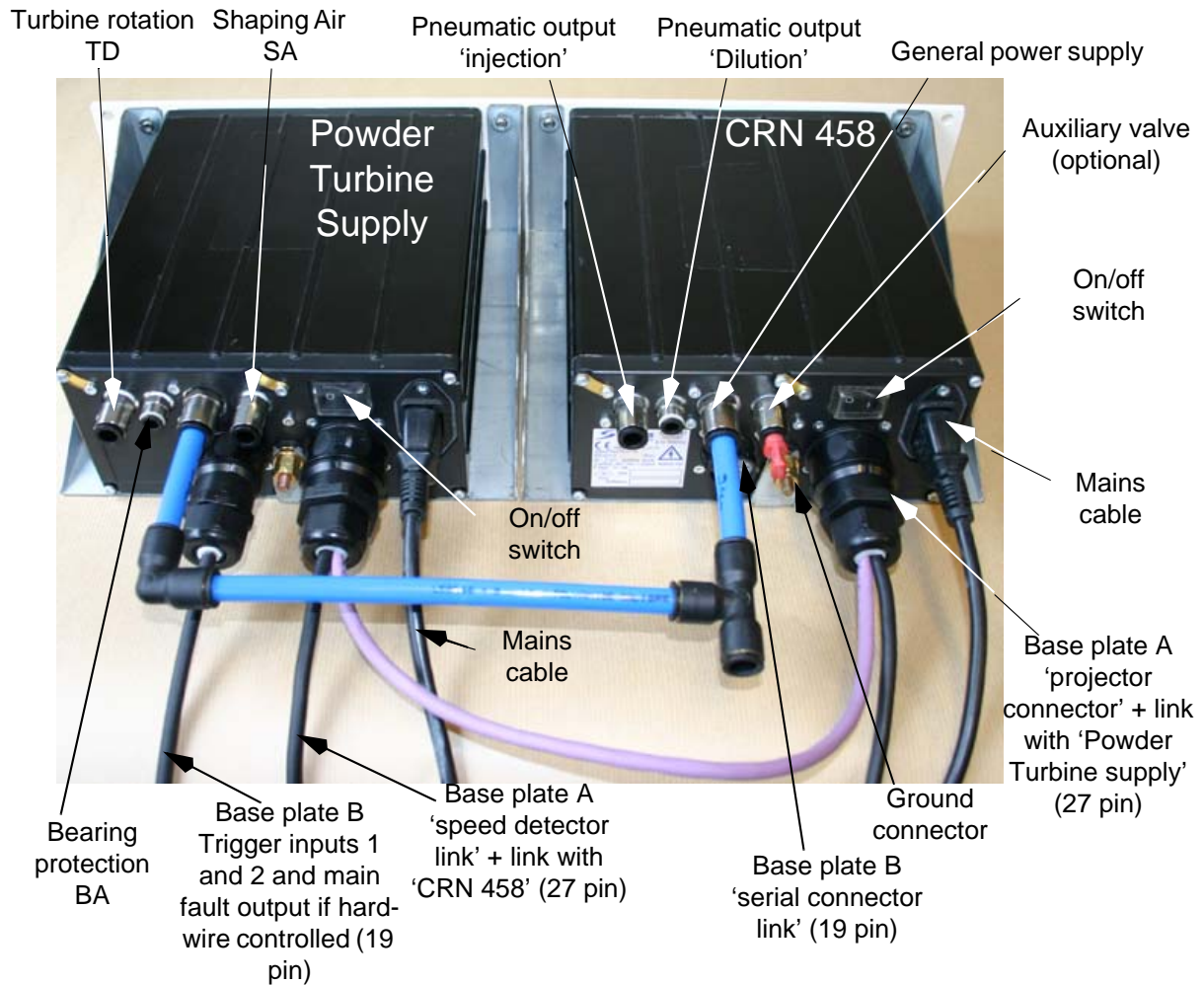
Settings	Factory value	Minimum	Maximum
Communication speed	9600 baud	1200 baud	38,400 baud
Auxiliary EV action synchronised with the trigger	0	0	1
HT local' HV action on the keyboard or external inputs	0	0	1
'Turb Local' Turbine action on the keyboard or external inputs	0	0	1

The communication speed is selected from the following list: 1200, 2400, 4800, 9600, 14,400, 18,200, 38,400 baud



It is possible to return to the original 'factory' setting at any time by holding down buttons '1' and '2' simultaneously during module start-up (on/off switch at the back of the control module).

4.1. TCR module connections

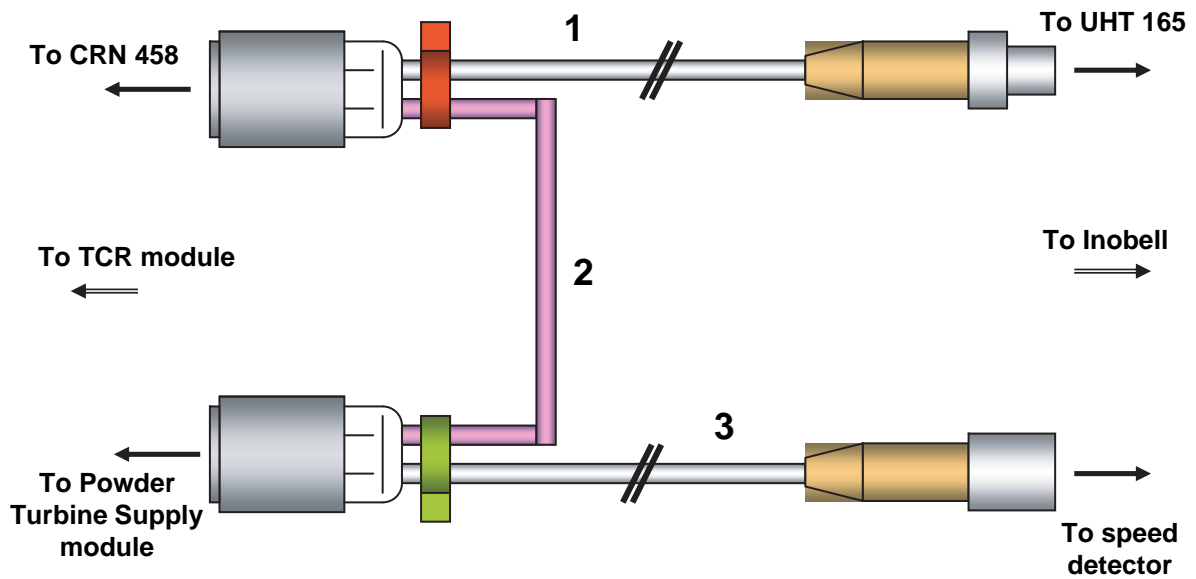


WARNING : The TCR module must be grounded through the CRN 458 module ground connector by a ground wire. The 'Powder Turbine Supply' module ground connector is not required.

Pneumatic connections:

General power supply	8/10 rilsan
TD, BA and SA supply	6/8 rilsan or 5.5/8 polyurethane
Injection air supply	6/8 rilsan
Dilution air supply	4/6 rilsan
Auxiliary valve	6/8 rilsan

Wiring diagram (Wiring P/N: 910007567)



DES04470

Cable 1: CRN 458/ HVU 165

Pins (CRN 458)	Pins (UHT 165)	Name	Colour
P	1	Primary U	Brown
M	2	Feedback I	White
N	3	Primary U	Blue
L	4	Recognition	Black
K	Base plate	Shield	

Cable 2: CRN 458/ 'Powder Turbine Supply' Module

Pins (CRN458)	Pins (Powder Turbine Supply)	Name	Colour
U	K	Shield	
C	N	RS 485 A	Brown
D	P	RS 485 B	White

Cable 3: 'Powder Turbine Supply' module/ Speed detector

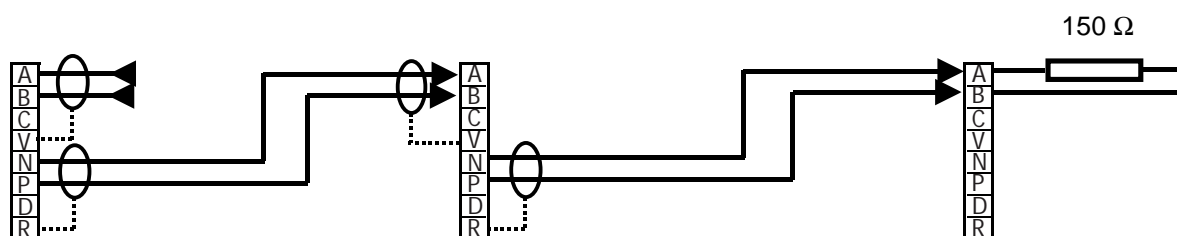
Pins (Powder Turbine Supply)	Pins (Speed detector)	Name	Colour
E	1	V+ detector	Brown
F	3	0V detector	Blue
D	4	Speed feedback	Black
U	2	Ground	White
V	Base plate	Shield	

4.1.1. 19-pin controlling connector with serial link to CRN 458

Pins	Name	Correspondence
A	A in	Serial link input
B	B in	
C	0V in	
V	Shield (in)	
N	A out	Serial link output
P	B out	
D	0V out	
R	Shield (out)	

Serial link connection (example with 3 CRN 458)

Sames Technologies requires use of shielded cabling (P/N: 110000029).
End resistance of 150Ω ($\pm 5\%$) line is set for this cable.



WARNING : In order to comply with current EMC standards, the PLC link cable must be equipped with a general shield connected to the U pin of the 19 pin connector. At the other end of the cable, the shield must be connected either to the cabinet or PLC ground wire.

4.1.2. 19-pin hard-wired control connectors

Pins	Name	Correspondence
C	0V	Rotation trigger input (dry contact)
P	Trigger contact	
R	Trigger shield	
D	0V	HV trigger + air shroud input by dry contact
N	Trigger contact	
V	Trigger shield	
E	Common	Fault relay output (0.5A/24V)
F	NF	
G	NO	

5. Description of control module

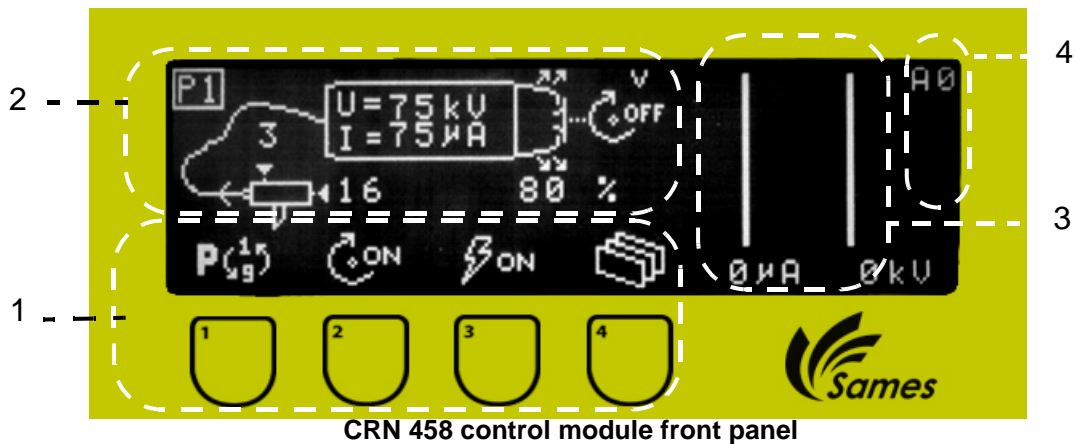
The function of the automatic projector is to project electrically charged powder by means of a High Voltage Unit built into the projector that supplies power at up to 75kV and 110 μ A.

5.1. Functions available from control module



WARNING : The settings on the various screens can only be accessed in local mode.

The control module displays the parameters and their settings, which can be changed using the four buttons on the front panel.



CRN 458 control module front panel

Five different menus can be accessed by the operator:

- **A0:** choice of function tables and high voltage and turbine rotation selection/de-selection
- **A1:** change the settings in the selected table.
- **A2:** fault log (accessible only if a fault has been logged).
- **A3:** display settings (contrast, etc.).
- **A4:** display operating settings.

Area 1: The front panel of the module has four buttons.

An icon located above each button shows the button's purpose.

Area 2: This display area indicates parameter status and displays the projector's function.

In the example: with screen **A0**, the injection air (powder flow rate) is at 16, the dilution air is at 3. The function table used is P1 (on first use of the module, the P1 function table is always displayed). Shaping air is at 80% and turbine rotation speed is zero.

Area 3: The scale in this area shows the instantaneous voltage and current values in graphic and numerical form.

Area 4: This area shows the screen the operator is operating.



If this logo appears in area 4, it indicates that the generator has shut down because of a fault ([see § 6.6.1 page 20](#)).



If this logo appears under [A0] in area 4, it indicates that the operator has deselected the projector.



When the trigger is pressed, this logo flashes (the arrow at the bottom of area 4 indicates high voltage).

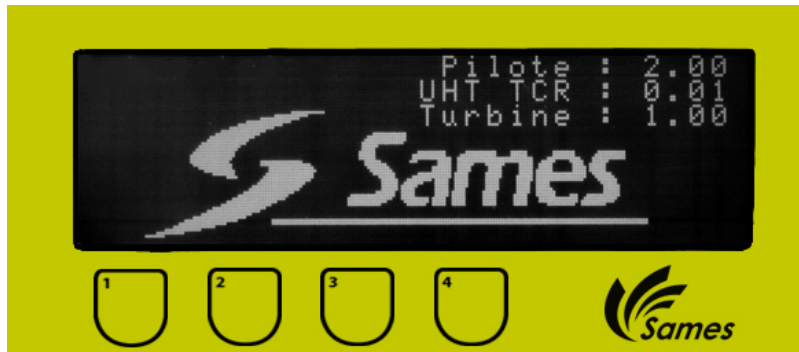


Information alert 'Temperature too high'.

6. Use of the different control module menus

6.1. CRN 458 initialisation screen

This is the first screen displayed on start-up of CRN 458.



Press buttons 1 and 2 simultaneously to restart the device with factory settings. Here the operator is in a first start-up situation.

6.2. Start-up screen: Screen A4

At first start-up, the operator must enter this data. By default, the factory settings are validated. They can always be viewed but can only be changed at first start-up or following a restart with factory settings.



On this screen, it is possible to choose to control triggers 1 and 2 by dry contact, or directly using the keyboard.

Auxiliary EV: 0 auxiliary valve unused.

Auxiliary EV: 1 auxiliary valve used and activated when HV is requested.

HT Local and Turb Local: 0 means that High Voltage and turbine control are controlled using dry contacts.

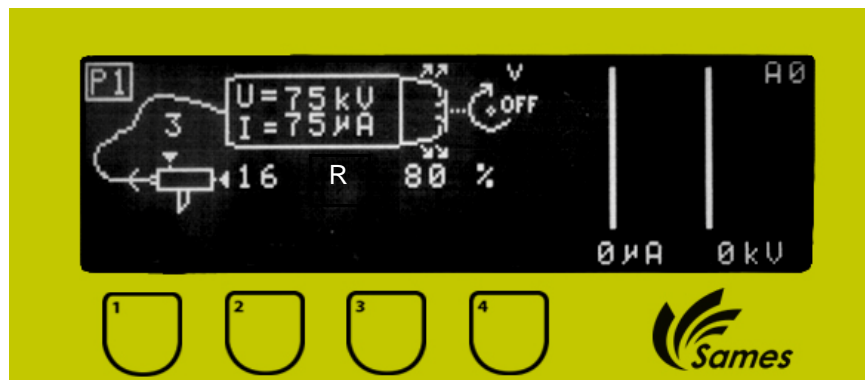
HT Local and Turb Local: 1 means that High Voltage and turbine control are controlled directly from the keyboard.

Other possible display:

Turb Local: 1 keyboard control for rotation

HT Local: 0 High Voltage control by dry trigger contact.

6.3. Screen displayed in serial link mode



In Serial Link Mode it is possible:

- either to choose a table from predefined tables P1 to P9: the selected table number is displayed.
- or to input different settings in which case table P0 is displayed.
- to have an automatic cleaning mode (contact Sames Technologies).
 - when cleaning is selected by the supervisor, a 'Cleaning' logo (cloth) appears.
 - the cleaning function supplies the powder pump with air at a maximum flow rate without high voltage power and with shaping air and turbine rotation.

6.4. 'A0' Settings display screen

This screen is used to display projector function. The operator can use the keyboard to choose the required function table.

Full keyboard control

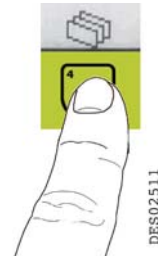


[1]: This area is used to choose the required function table.

There are 9 different tables (from 1 to 9). It is possible to change the settings of each table individually.

If high voltage is on it is impossible to change the table.

[3]: Use this key to switch to the next menu A1.



[2]: Use this area to turn on the turbine (key 2) and the high voltage and powder supply (key 3)

Pressing these keys displays these icons.
Turbine rotation and HV are on.
Turbine rotation and HV are off.



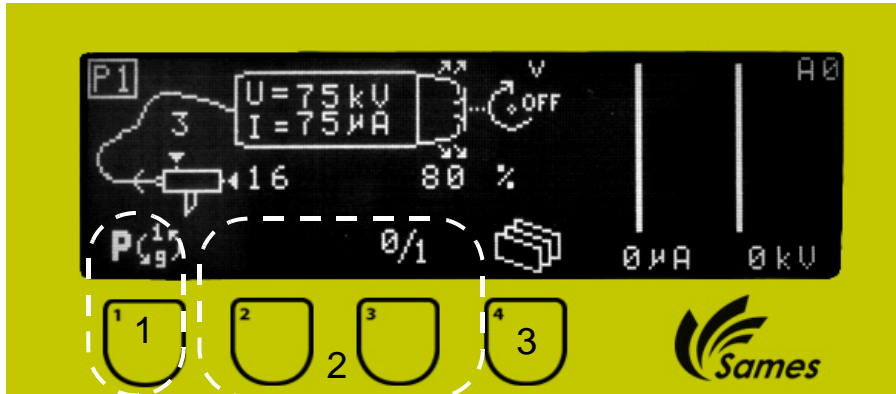
Note: Always turn on turbine rotation before switching on High Voltage.
The TCR module does not allow powder projection if the bell cup rotation speed is less than 3000 rpm. If this is not the case error no. 24 will be displayed.

[4]: This area gives information about the rotation speed:



- when speed is zero 'OFF' is displayed on the screen and the arrow does not flash.
- when the turbine is rotating, the arrow flashes. If the speed is not stabilised at the speed setpoint, 'ON' is displayed and flashes.
- when speed stabilises, only the arrow flashes and 'ON' switches to 'OK'.

Turbine rotation and High Voltage control by external dry contact



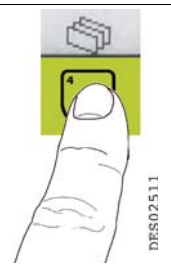
[1]: This area is used to choose the required function table.

There are 9 different tables (from 1 to 9). The settings of each table can be changed individually.

If High Voltage is on it is impossible to change the table.

[3]: Use this key to switch to the next menu A1.

If High Voltage power is on, the next screen 'A1' cannot be accessed.



[2]: This area shows the operator that dry contact control is on both for the turbine and High Voltage. Nevertheless it is possible to have only external control on either of the two functions.

Press key 3 to select/ deselect the module.



This logo appears below A0

6.5. Screen 'A1'

This screen is used to adjust injection and dilution air, voltage, current, rotation speed and shaping air settings.

Dilution air is used to avoid spray pulsing. This setting also affects the powder spray speed. Injection air is used to adjust the powder flow rate.



[1]: This area is used to adjust injection air, dilution air, shaping air, voltage, current and rotation speed settings (V-, V, V+).

The operator can select the powder flow rate (injection air) from thirty-two possible settings (from 0 (zero flow rate) to 31) and adjust the dilution air from eight different settings (from 0 to 7). The shaping air can also be set a value between 0 and 100%



Reduction in dilution air:
slower spray and risk of pulsing.

DES02499



Increase in dilution air: faster spray and less pulsing.

DES02500

3 Possible speed levels:

V- : 6500 rpm +/- 100 rpm

V : 7500 rpm +/- 100 rpm

V+ : 8500 rpm +/- 100 rpm

[2]: This button is used to place the flashing cursor by the setting to be changed: injection air, dilution air, voltage, current, shaping air and rotation speed.

[3]: Use this key to switch to the next menu.



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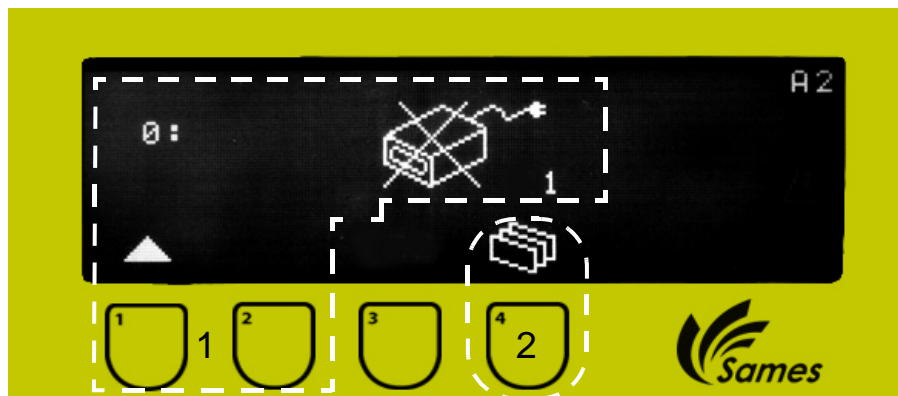
Changes are saved:

- If no setting changes have been made for 1 s.
- By pressing the HV trigger.
- By changing screen.

If no action is taken, the display automatically switches to screen 'A0' after one minute. Screen 'A0' appears immediately if the trigger is pressed.

6.6. Screen 'A2'

This screen is used to display the fault log.



[1]: The fault log is displayed in this area. The most recent fault appears on the screen with its number (1, in this case). The fault age index is indicated on the left-hand side of the screen: 0.



Faults displayed from oldest to most recent.



Faults displayed from most recent to oldest.

[2]: Use this key to switch to the next menu.



If no action is taken, the display automatically switches to screen 'A0' after one minute. Screen 'A0' appears immediately if the trigger is pressed.

If no faults are detected, the operator cannot access screen 'A2'

The last 96 faults are recorded; the 97th alters the list and deletes the 1st (oldest) fault.

If a fault occurs in the CRN 458 module, HV, powder and shaping air are shut off automatically:

- If the fault is minor, the operator can acknowledge it by pressing button '4' in zone 2. The operator can then restart the application by pressing the On/ Off button on the HV trigger.
- If the fault is major, the application can only be restarted by turning it off and on at the mains, provided that the problem has been resolved.

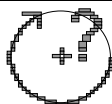
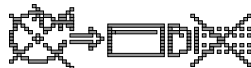


If a fault occurs in the 'Powder Turbine Supply' HV, powder, shaping and rotation shut down automatically:

- The operator can then restart the application by pressing the On/ Off button on the HV and rotation triggers.
- If the fault is major, the application can only be restarted by turning it off and on at the mains, provided that the problem has been resolved.

NB: Before switching On/ Off at the mains, the operator must ensure that the triggers have first been switched off.

6.6.1. Fault list

Fault number	Module	Fault Reset	Icon	Notes
1	TCR	HV and turbine triggers		'CRN 458' general fault
2	CRN 458	OFF/ON Mains supply		No HV projector connection
3	CRN 458	HV trigger		'CRN 458' high temperature
4	TCR	HV and turbine triggers		Trigger action forbidden
5	CRN 458	HV trigger		'CRN 458' general fault
6	CRN 458	HV trigger		'CRN 458' general fault
7	CRN 458	HV trigger		'CRN 458' general fault
8	CRN 458	HV trigger		'CRN 458' general fault
9	CRN 458	OFF/ON Mains supply		Short-circuit on electrode
10 to 18	CRN 458	HV trigger		Solenoid valve index Vi (V1 to V8), Vx: Auxiliary solenoid valve
19	Powder Turbine supply	OFF/ON Mains supply		'Powder Turbine Supply' module disconnected
20	Powder Turbine supply	HV and turbine triggers		Excessive turbine rotation
21	Powder Turbine supply	OFF/ON Mains supply		No speed signal
22	Powder Turbine supply	HV and turbine triggers		Powder Turbine Supply module high temperature

Fault number	Module	Fault Reset	Icon	Notes
23	Powder Turbine supply	HV and turbine triggers		Turbine control at max setting
24	CRN 458	HV trigger		High voltage and powder switched on before sufficient speed reached
25	CRN 458	HV trigger		Spark risk detected: too close/ low voltage
26	CRN 458	HV trigger		Spark risk detected: part approached too quickly / Di/Dt soft

Faults 1, 5, 6, 7 and 8 are caused by power electronics problems. Switch the control module off and on. If the problem persists, contact Sames Technologies.

Fault 2 is caused by a connection problem between the CRN 458 module and the projector (no low voltage connection).

Faults 3 and 22 are caused by high temperature inside the control modules. Ensure that temperature of compressed air never exceeds 40°C.

Fault 4 appears when at least one trigger is engaged at spray gun start-up Rearm by releasing the trigger(s) and pressing it again.

Fault 9 appears when there is a short-circuit on the projector. Rearm by pressing the On/ Off button on the CRN 458. Check projector wiring.

Faults 10 to 18 are detected when electrical power supply faults occur on the different solenoid valves. If a fault of this nature occurs, contact Sames Technologies.

Faults 19 to 23 relate only to the 'Powder Turbine Supply' module.

Fault 20 indicates that turbine rotation speed is abnormal.

Fault 21 indicates no feedback information from the speed detector.

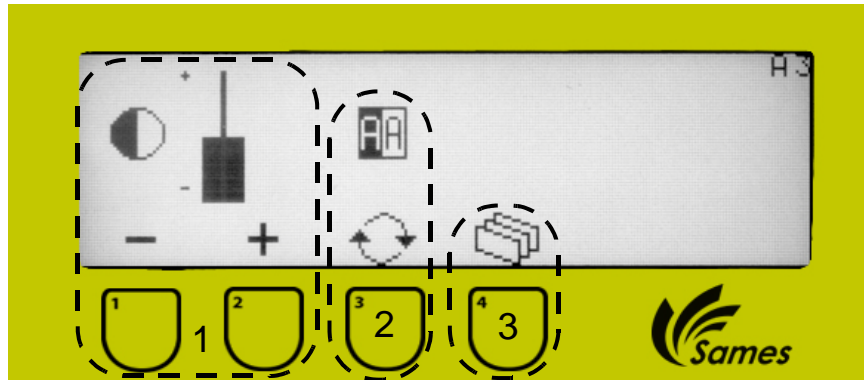
Fault 23 indicates that the programmed speed setpoint cannot be reached.

Fault 24 detects a synchronisation problem between rotation speed and High Voltage.

Faults 25 and 26 are safety mechanisms required to warn of electrical sparks in explosive atmospheres.

6.7. Display set-up screen: Screen 'A3'

This is used to adjust screen settings.



[1]: Use this area to adjust screen contrast. Pressing the buttons operates the following commands:



Reduce contrast, making the screen increasingly brighter.



Increase contrast, making the screen increasingly darker.

[3]: Use this key to switch to the next menu.



The changes are validated:

- If no setting changes have been made for 1 s.
- By pressing the trigger.
- By changing screen.

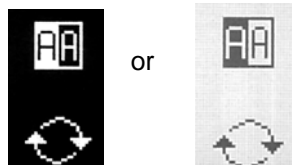
If no action is taken, the display automatically switches to screen 'A0' after one minute.

[2]: This area is used to toggle screen colours.

Pressing this button toggles between display settings:

- either the display is white on a black background.
- or the display is black on an white background.

This appears on the screen:



6.8. Screen 'A4'

At this stage, it is only used to view configuration settings.



[1]: Press this button to switch to the next menu.

If no action is taken, the display automatically switches to screen '**A0**' after one minute.

Screen '**A0**' appears immediately if the trigger is pressed.



7. Spare parts list



Item	Part number	Description	Qty	Unit of Sale	Spare Part Level (*)
	900005533	Complete TCR module	1	1	3
1	110000990	CRN 458 module only	1	1	3
2	110000991	'Powder Turbine Supply' module only	1	1	3
3	250000078	F/90 HC M6 x 12 galvanized steel screw	4	1	3
4	X3GJFP118	PT F/90 HA 40x10 WN1413 zinc-plated	8	1	3



Item	Part number	Description	Qty	Unit of Sale	Spare Part Level (*)
1	910007567	Inobell/ TCR module connector cable	1	1	3
2	E4PCAL206	'European' 10A 250V Mains power cable	2	1	3
	E4PCAL501	'UK' mains power cable	-	1	3
3	F6RLZX397	Quick-release plug, dia: 8	2	10	3
4	F6RLTS211	Tee union dia: 10	1	1	3
5	F6RLDS209	Plain elbow union - dia. 10	1	1	3
6	E4PTFS572	19-pin male connector	2	1	3
	E4PTFD574	Crimp contact	**	1	3
	W6EDEM090	Removal tool for 19-pin connector	1	1	3

(*) **Level 1: Standard preventive maintenance**
Level 2: Corrective maintenance
Level 3: Exceptional maintenance.

(**) **Quantity: 8 for serial connector link and 9 for hard-wired connector.**

7.1. Extension lead between UHT 165 / CRN 458 and Speed Detector/ 'Powder Turbine Supply' module

Note: Extension lead length is standard. For different lengths, contact SAMES.

These extension leads connect each end of the cable (P/N: 910007567) from the speed detector at one end and the HVU at the other. Two extension leads can be connected to one another.



WARNING : The total length of cable(s) between the High Voltage Unit and the TCR control module must not exceed 30m. The same applies between the speed detector and the TCR module.

Item	Part number	Description	Qty	Unit of Sale	Spare Part Level (*)
	110000972	Extension lead, moulded male/ female connectors, length: 15m	2 max	1	3

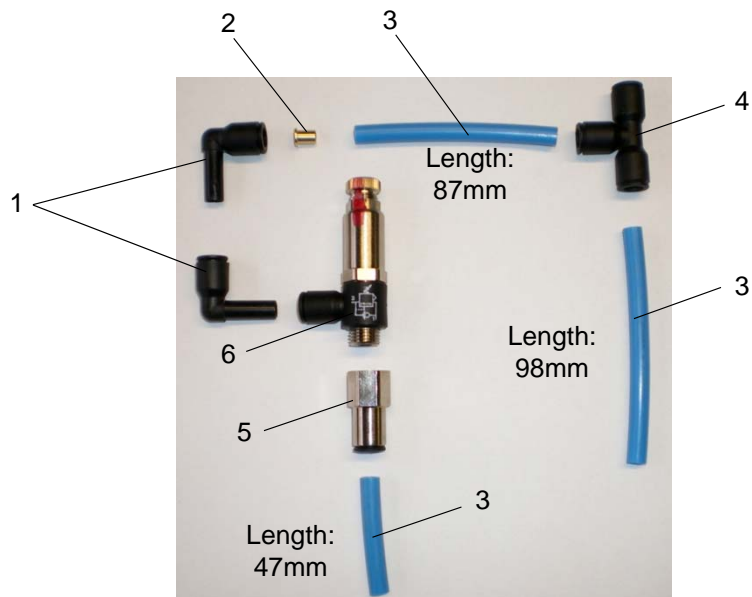
(*)

Level 1: Standard preventive maintenance

Level 2: Corrective maintenance

Level 3: Exceptional maintenance.

7.2. Increased flow kit



Item	Part number	Description	Qty	Unit of Sale	Spare Part Level (*)
	910003361	High flow kit	1	1	3
1	F6RLDS408	Reducing elbow	2	1	2
6	910003449	Regulator connector	1	1	2
5	F6RLUS459	Straight union - female	1	1	2
2	900002308	Brass restrictor dia: 0.9	1	1	2
3	U1CBBT003	Blue rilsan hose, dia.: 6/8	0.232	m	2
4	F6RLTS210	Tee union dia: 8	1	1	2

For installation, contact Sames Technologies.

Connect the kit directly to the quick-release connectors.

