SAMES KREMLIN

User manual

SLR S-BOX panel and pack (Version ≥ 2.0) Operating manual

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SLR S-BOX panel and pack (Version > 2.0) Operating manual

This user manual contains links to the following user manuals:
- see RT Nr 6213 for the GNM 200 control module.
- see RT Nr 6423 for the BSC 100 turbine speed controller.
- see RT Nr 6435 and see RT Nr 6436 for the REV 800.

1. Description

The operating manual can guide users when commissioning and using the SLR-type panel and pack.

The SLR module is designed to supply and control:
- a maximum of 2 S-BOX (BELL or 2-GUN) modules.
- 1 PFS module (color change module)
- 1 GPC module (gear pump control module)
- 1 REV 800 module (complete robot RFV 2000 control module).

Equipment is integrated in a 12U-type pack (800*600*800) to control one single S-BOX module, or in a 42U-type panel (2100*600*600) in all other cases.

Synoptic:

4 — SAMES KREMLIN — PFS

5 — SAMES KREMLIN — GPC

REV 800 — SAMES KREMLIN

6 — TOUCH — SIMATIC HMI — SIEMENS

3 — SAMES KREMLIN — S-BOX GUN
OFF

3 — SAMES KREMLIN — S-BOX GUN
OFF
1 : Master
- : Slave
0   1

1 — SAMES KREMLIN — SLR
ON
SLR

2 — SAMES KREMLIN — S-BOX BELL
STOP
Air 0 Sol

2 — SAMES KREMLIN — S-BOX BELL
STOP
Master
Slave
Air 0 Sol
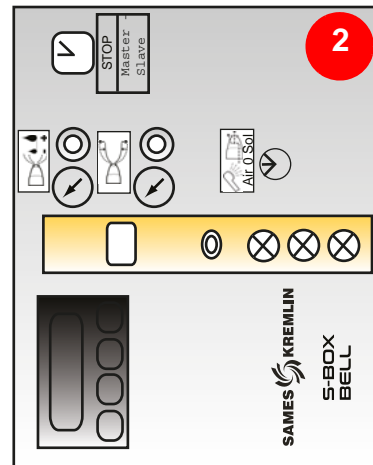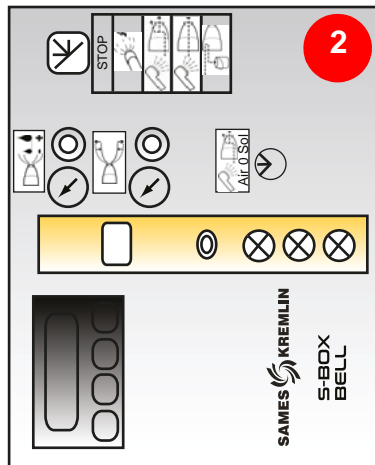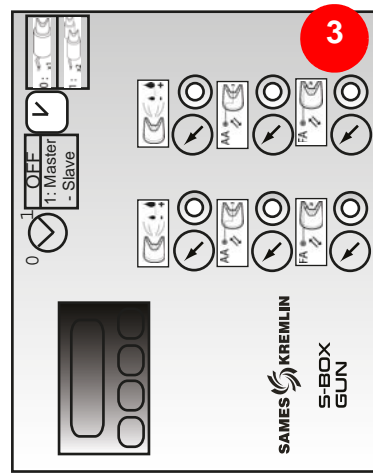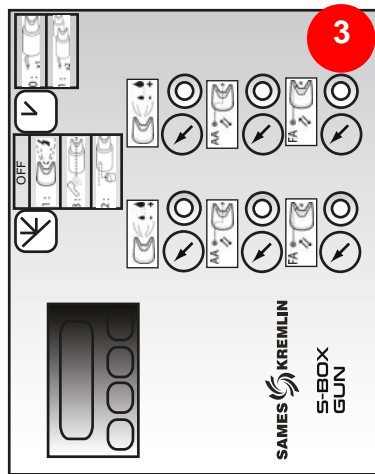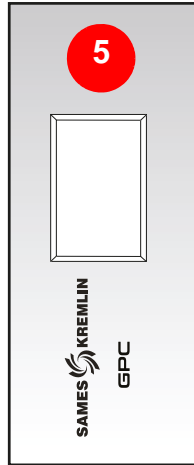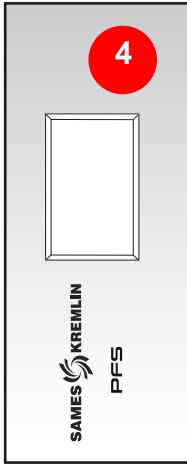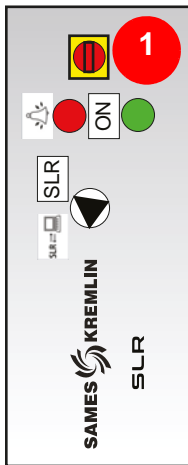
1	**SLR module** **(Sames Liquid Rack)**	External interfaces (supply-control-safety) SBOX interface Peripheral modules interface
2	**S-BOX-BELL module**	Sprayer pilot 1 Master + 1 Slave
3	**S-BOX-2-GUN module**	Electropneumatic gun pilot 1 Master + 1 Slave
4	**PFS module** **(Product Flush Selection)**	Manages color changes with 1 to 2 circuits, up to 6 colors per circuit
5	**GPC module** **(Gear Pump Controller)**	Pilot of 2 gear pumps
6	**REV 800 module**	Pilot of 2 "up and down" RFV robots Trigger control

2. Operating principle for the SLR module

Fault signal indicator

General power switch

Green light switch
- Local mode (SLR, on the right)
- Remote mode (on the left)
Indicator: SBOX mode requested

Green light pushbutton:
- ON
- Reset fault
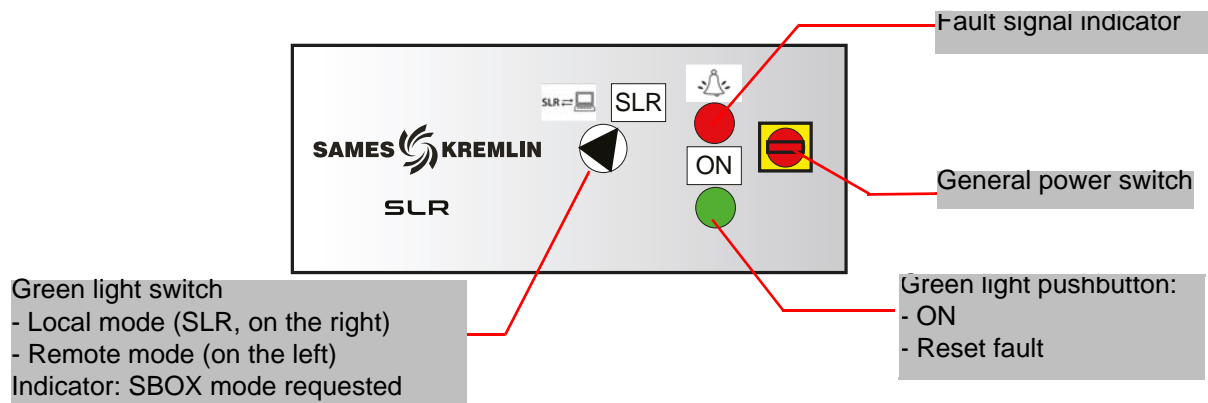
2.1. Power up
The SLR module can be powered up using the general switch on the front panel.
A 2*16 Am fuse holder (in the rack), protects the system in the event of a fault.
At power-up, the 24 VDC control voltage is confirmed.
The micro-PLC (behind the rack) operates in RUN mode.
SBOX modules are supplied with 24 VDC (Turbine rotation card, pressure switch, etc.).

2.2. Start-up
To start the system, the following conditions must be satisfied:
- No emergency stop (external or emergency stop button located on the left side of the SLR panel).
- External start-up authorisation confirmed (condition: external hardwire for terminal box XC1).
- Bearing air S-BOX-Master present for a SBOX BELL module.
- Bearing air S-BOX-Slave present for a SBOX BELL and if active (selector set to ON).
- Booth ventilation active (condition: external hardwire for terminal box XC1).

The operator can then press the illuminated ON button, to activate the main contactor.
If the system is operating:
- The green SLR push button is activated.
- GNM are supplied with 230 VAC (green GNM indicator).
- The general air valve is activated.
- The peripheral modules present (GPC, PFS and REV 800) are supplied.

2.3. Control and signalling
Green light pushbutton ON:
- System start-up
- Clear emergency stop fault (safety relay PILZ)
- Clear SLR fault
- Indicator light ON: system started

Red FAULT indicator:
- SLR fault present

REMOTE / LOCAL mode selector:
- Local mode: SBOX controlled locally from the master SBOX by the operator.
- Remote mode: SBOX controlled remotely, via external orders (terminal box XC2).
- Green indicator: indicates that the Selected mode of the SBOX (Spraying – Head rinsing - Rinsing – Dump) is confirmed.

2.4. Faults

Description	Conditions	Actions
Emergency stop	Panel emergency stop (located on the left side of the panel) or external emergency stop (terminal box XC1 1-2, 3-4)	Shutdown
Booth ventilation	No booth ventilation	Shutdown
Bearing air 1 present (not valid with S-BOX Gun)	No S-Box 1 bearing air	Shutdown
Bearing air 2 present (not valid with S-BOX Gun)	No S-Box 2 bearing air	Shutdown
S-BOX1 fault	Fault GNM 1 or turbine card 1 or bell 1 present	Spraying stops and high voltage stops for S-BOX 1
S-BOX 2 fault	Fault GNM 2 or turbine card 2 or bell 2 present	Spraying stops and high voltage stops for S-BOX 2
Detection module fault	REV 800 module fault	Spraying stops and high voltage stops for S-BOX 1 and S-BOX 2
Circuit fault	PFS module or GPC module fault	Spraying stops and high voltage stops (S-BOX 1 and 2), rinsing and dump stop.

WARNING : All faults are maintained, they can be cleared using the green light push-button, if they have physically disappeared.

2.5. Settings and configuration

2.5.1. Part detection
Two cases must be distinguished:
1. ″**Part sensors**″ are not used, PLC input is confirmed at all times (terminal box XC1)
2. ″**Part sensors**″ are used, spraying is therefore activated on the basis of the logic described below.

Different time delays can be used to define spray times. In fact, a duration is calculated based on conveyor speed (considered as fixed), and the distance between the sprayers and the part sensor.

For the S-BOX 1:
- T1: Time delay between the sensor and the paint activation zone.
- T2: Time delay between the end of paint activation and the detection of the first part.
- T3: Time delay between the end of paint activation and the detection of the last part.
- T4: Time delay for the integration of spray shutdown, when the conveyor restarts.

Spraying will start when the first part is detected, after time delay T1. In the absence of the next part (empty conveyor detected), spraying will remain active during T2.
If parts are continuous (no empty conveyor detected), spraying will remain active for all parts and until after time delay T3, after the last part is detected.
Spraying will stop when the conveyor stops or for a system fault. Spraying will restart when the conveyor restarts and the fault disappears, and will remain active during T4 to avoid losing parts during spraying.

For the S-BOX 2:
- T8: Time delay between the sensor and the paint activation zone.
- T9: Time delay between the end of paint activation and the detection of the first part.
- TA: Time delay between the end of paint activation and the detection of the last part.
- TB: Time delay for the integration of spray shutdown, when the belt restarts.

Spraying will start when the first part is detected, after time delay T8. In the absence of the next part (empty conveyor detected), spraying will remain active during T9.
If parts are continuous (no empty conveyor detected), spraying will remain active for all parts and until after time delay TA, after the last part is detected.
Spraying will stop when the conveyor stops or if a system fault appears, will restart when the conveyor restarts, and when the fault disappears, and will remain active during TB to avoid losing parts during spraying.

Generally, T2 = T3 and T9 = TA.
Detection logic fails to allow spraying to stop (ON/OFF) between 2 successive parts. Spraying will only stop if empty spaces between parts are long enough, such that a part is not detected before the end of the spraying of the previous part.

Example configuration for the definition of timing parameters:
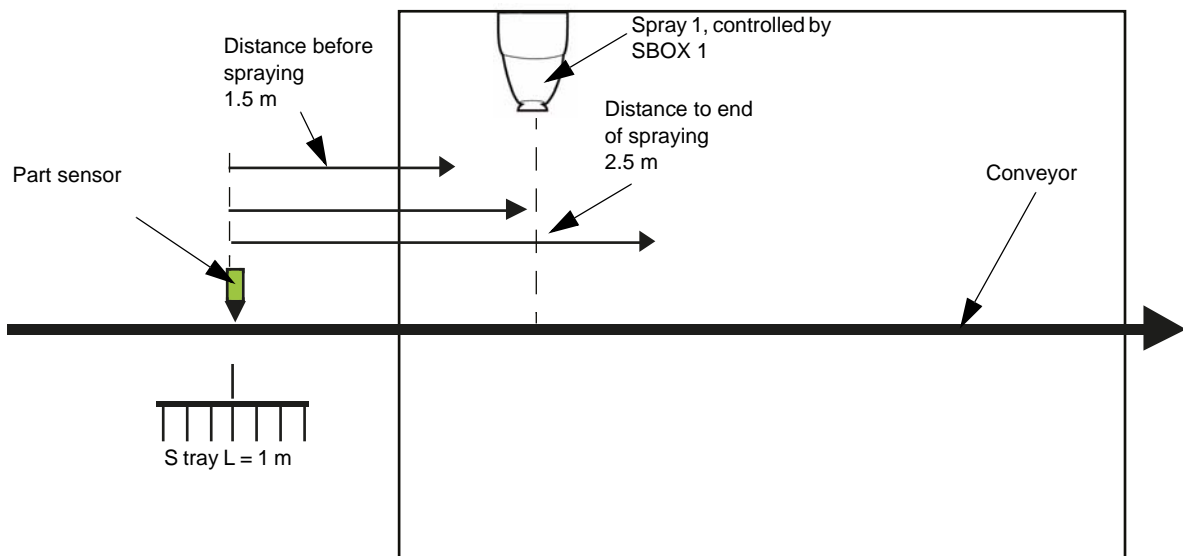
Data:
- Fixed conveyor speed: Vbelt=1.8 m/min = 0.03 m/s.
- Distance between Spray axis 1 and the detection of the part: dP1 = 2 m
- Suspended tray length: S tray L = 1 m

Calculated values:
Distance between the part sensor and the start of spraying: dP1- (StrayL/2) = 1.5 m
Which corresponds to a duration of: 1.5 m/ Vbelt = 50 s

Distance between the part sensor and the end of spraying: dP1+(StrayL/2) = 2.5 m
Which corresponds to a duration of: 2.5 m/ Vbelt = 84 s

Configuration required for SBOX-1.
T1 =50 s, T2 =84 s and T3 =84 s.
These values are only theoretical values and must be adjusted on site.
For configuration and default time delay values .

2.5.2. Micro-PLC
Located behind the rack.
Input and output states can be read directly off the LCD.

List of inputs/outputs

Logic input			
	Description	**Remarks**	**Initial conditions for start-up**
I1	Remote / local mode	1 = Local	
I2	Part detection		
I3	Emergency stop / Booth ventilation	0 = Fault	X
I4	Conveyor operating		
I5	External spray 1 trigger order	Remote mode: external spray 1 trigger	
I6	External HV 1 trigger order	Remote mode: external HV 1 trigger	
I7	External spray 2 trigger order	Remote mode: external spray 2 trigger	
I8	External HV 2 trigger order	Remote mode: external HV 2 trigger	
I9	S-BOX1 pack with fault	1=No fault, Turbine card fault, GNM fault, Bell 1 detection fault	
IA	S-BOX 1 bell and bearing air present	Bearing air pressure switch data	X
IB	S-BOX 1 turbine speed or S-BOX GUN validation	0-10V 0-100 krpm turbine speed or if Input =1 S-BOX1=gun	
IC	Local S-BOX spray request	Request from switch 5 Master S-BOX positions	
ID	Local S-BOX head rinsing request	Request from switch 5 Master S-BOX positions	
IE	Local S-BOX rinsing request	Request from switch 5 Master S-BOX positions	
IF	Local S-BOX dump request	Request from switch 5 Master S-BOX positions	
IG	S-BOX 2 turbine speed or S-BOX GUN validation	0-10V 0-100 krpm turbine speed or if Input =1 S-BOX2=gun	
IH	S-BOX 2 confirmed	Confirms the presence of the S-BOX 2	
IJ	S-BOX 2 with fault	1=No fault, Turbine card fault, GNM fault, Bell 2 detection fault	
IK	S-BOX 2 bell and bearing air present	Bearing air pressure switch data	X: if S-BOX 2 confirmed
IL	Q1output invert	From version V2.2 onwards if IL is at 1 Q1 is a fault information If IL is set to 0 (default) Q1 is a Conveyor Authorization Information	
IN	Reset fault	Green ON push-button	
IP	PFS: Enabled mode	Information transferred to the PFS	
IQ	PFS /GPC module faults (Circuits)	Spraying and High voltage / dump / rinsing stop	
IR	Module fault (movements) REV 800	Spraying and high voltage stop	

Logic output			
		Description	**Remarks**
Q1		Fault or conveyor authorization according to	Data available on the terminal
Q2		S-BOX supply	S-BOX power-up
Q3		Fault	Red indicator on front panel
Q4		Ready to operate	Green indicator on the Mode selector
Q5		S-BOX-1 GNM HV trigger	
Q6		S-BOX-2 GNM HV trigger	
Q7		S-BOX-1 spraying EV	
Q8		S-BOX-1 head rinsing EV	
Q9		S-BOX-1 dump EV	
QA		S-BOX-2 spraying EV	
QB		S-BOX-2 head rinsing EV	
QC		S-BOX-2 dump EV	
QD		Spraying mode	Operating signals for PFS module
QE		Head rinsing mode	Operating signals for PFS module
QF		Rinsing mode	Operating signals for PFS module
QG		Dump mode	Operating signals for PFS module

Display of logic input states (1 to 9, A to R)

Display of logic output states (1 to 9, A to G)

PLC operating state: RUN
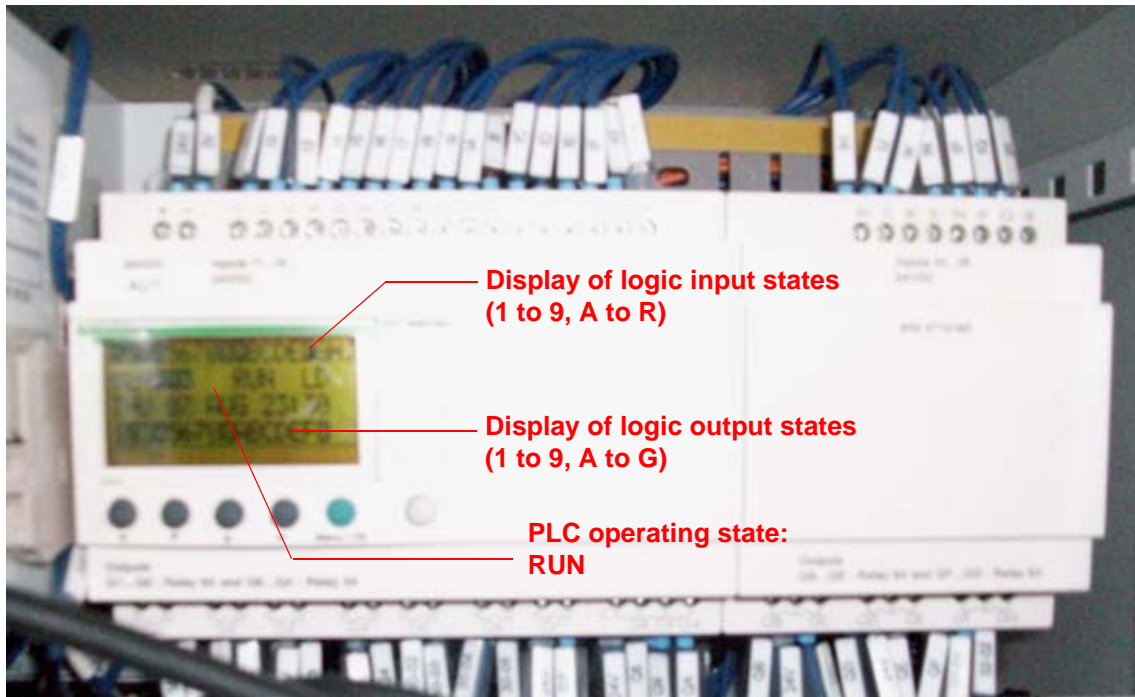
2.5.3. Configuring time delays of spraying

Time delays T1 to T6 and T8 to TB can be modified using the micro-PLC. These time delays are used to define spraying zones (Spray 1 and Spray 2) (see § 2.5.1 page 9).
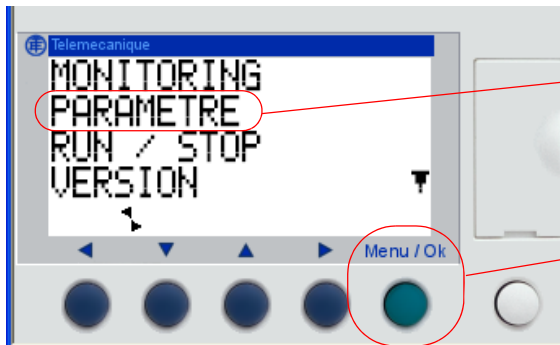
Press on the arrows ▲ and ▼ to select the "**PARAMETER**" line.

Press **Menu /Ok**
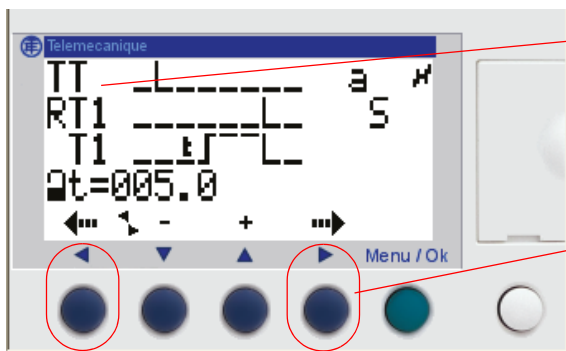
The figure **1** on the top line will flash Corresponds to T1.

Select the value of T1 to change the time delay T1 using the keys:
◄ . ► .
The value "005.0" will flash.
Adjust the time in seconds using the key ▲ to increase the value and ▼ to decrease the value.
After modifying the value, confirm the new value by pressing **"Menu / OK"**

"Yes" will flash.
Press "**Menu / OK**" to confirm your input.

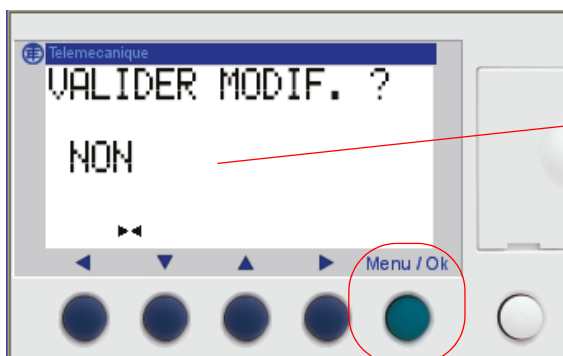| Item	Description	Default value
T1	Period between the sensor and the S-BOX 1 paint activation zone	5 s
T2	Period between the end of paint activation and the detection of the first part for S-BOX 1.	15 s
T3	Period between the end of paint activation and the detection of the last part S-BOX 1	15 s
T4	Period for the integration of spray shutdown, when the S-BOX 1 conveyor restarts	30 s
T5	Duration for permanent spraying control	10 s
T6	Time to take into account spraying after restarting the conveyor (following an emergency stop or a ventilation fault)	5 s
T8	Period between the sensor and the S-BOX 2 paint activation zone	5 s
T9	Period between the end of paint activation and the detection of the first part for S-BOX 2.	15 s
TA	Period between the end of paint activation and the detection of the last part for S-BOX 2	15 s
TB	Period for the integration of spraying shutdown, when the S-BOX 2 conveyor restarts	30 s
TD	Time delay for the activation of the trigger valve after the spraying request S-BOX 1	0 s
TE	GNM1 HV trigger activation time delay after spraying request S-BOX 1	0 s
TF	Time delay for the activation of the trigger valve after the spraying request S-BOX 2	0 s
TG	GNM1 HV trigger activation time delay after spraying request S-BOX 2	0 s

The T5 time delay allows to differentiate a permanent spraying from a long part during detection. If the detection input is validated for a time greater than T5, then the system considers the detection to be permanent.

Delay time T6 is used to delay spraying after an emergency stop in order to wait for the conveyor to restart (conveyor or system restart time).

Time delays TD to TG can be used to desynchronise spraying and high voltage orders in local or remote mode if necessary.

2.5.4. Configuring turbine rotation speed thresholds

Speed thresholds are used for **IB** inputs, for the S-BOX BELL 1, and **IG** inputs for the S-BOX BELL 2. This refers to 0-10V input, just like turbine speed, indicated by the card ((0-100 Krpm = 0-10V). These thresholds can be modified using the front panel of the micro-PLC ZELIO, for each S-BOX according to the following procedure.
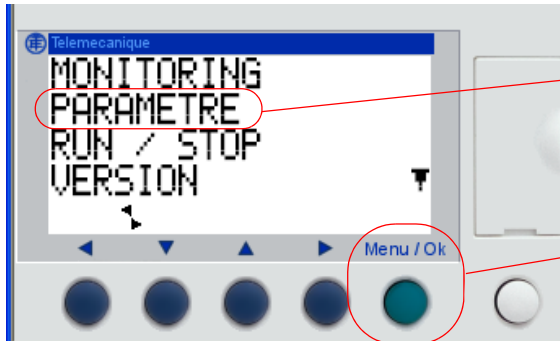
Press on the arrows ▲ and ▼ to select the "**PARAMETER**" line.
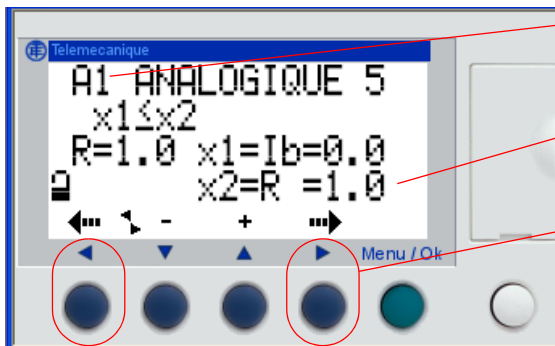
Press **Menu /Ok**

The figure **1** on the top line will flash
A1 corresponds to the S-BOX 1.
A2 corresponds to the S-BOX 2.

Threshold value: 1.0 corresponds to 10 Krpm

Select values using the keys ◄ . ► and then modify values using the keys ▲ and ▼
Press "**Menu / OK**" key to access the next view.
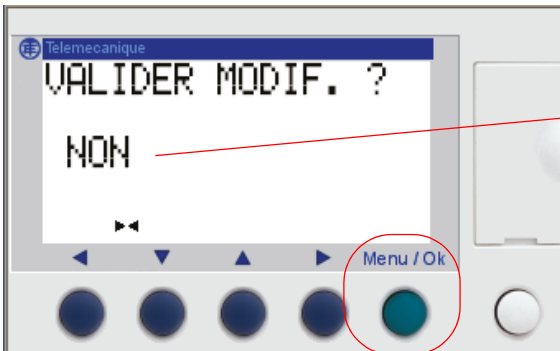
Select **YES** using the keys ◄ . ►
Press **Menu /Ok**

Item	Description	Default value
A1	SB1 turbine rotation speed threshold (10 = 100 Krpm)	2.0
A2	SB2 turbine rotation speed threshold (10 = 100 Krpm)	2.0

Thresholds are pre-set at 20 Krpm.

3. Operation of the SBOX-Bell module

Master S-BOX-BELL module

Pressure regulator paint air flow setting

GNM 200

Mode selector

Turbine speed control card

STOP

Pressure regulator peripheral air setting

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S-BOX BELL

Air 0 Sol

Air/solvent selector for head rinsing mode

Slave SBOX-BELL module

GNM 200 (or not for the water-based version)

Mode selector

STOP
Master Slave

Turbine speed control card

SAMES KREMLIN

S-BOX BELL

Air 0 Sol

Pressure regulator shaping air setting

Air/solvent selector for head rinsing mode

3.1. One SBOX-BELL or two SBOX-BELL

If two SBOX-BELL modules are used, the first SBOX-BELL is considered as the master SBOX-BELL, and the second as the slave SBOX-BELL.

In fact, the local operating modes (SPRAYING - HEAD RINSING - CIRCUIT RINSING – DUMP) are identical for the 2 SBOX-BELL, and are indicated by the master SBOX-BELL. The slave SBOX-BELL can be deactivated (mode selector set to STOP).

3.2. Start-up

The SBOX-BELL module is started using the SLR module.

Prior to start-up, adequate bearing air pressure (minimum 5.5 bar) is required for the sprayer, this adjustment is achieved using the pressure regulator (bearing air) located behind the SBOX-BELL module.

Checking the display threshold on the pressure switch SP23 (behind the SBOX).

If the SBOX-BELL is operating, the GNM 200 is live, and the turbine rotation card can operate (with 24 Vdc, and air pressure OK)

The microphone air pressure must be checked (behind the SBOX module) and the value must be between 1 and 2 bar.
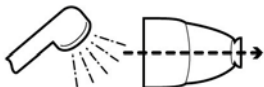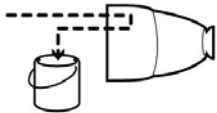
Turbine rotation can be checked, by maintaining the turbine card in LOCAL mode, and adjusting rotation speed using the adjustment knob. Turbine rotation speed must be higher than 20 Krpm (see RT Nr 6423).

- Turbine speed indication in KRPM
- Turbine speed control knob: 0-100% 60 Krpm (PAM turbine) 100 Krpm (THV).
- Mode selector set to LOCAL
- Fault indicator
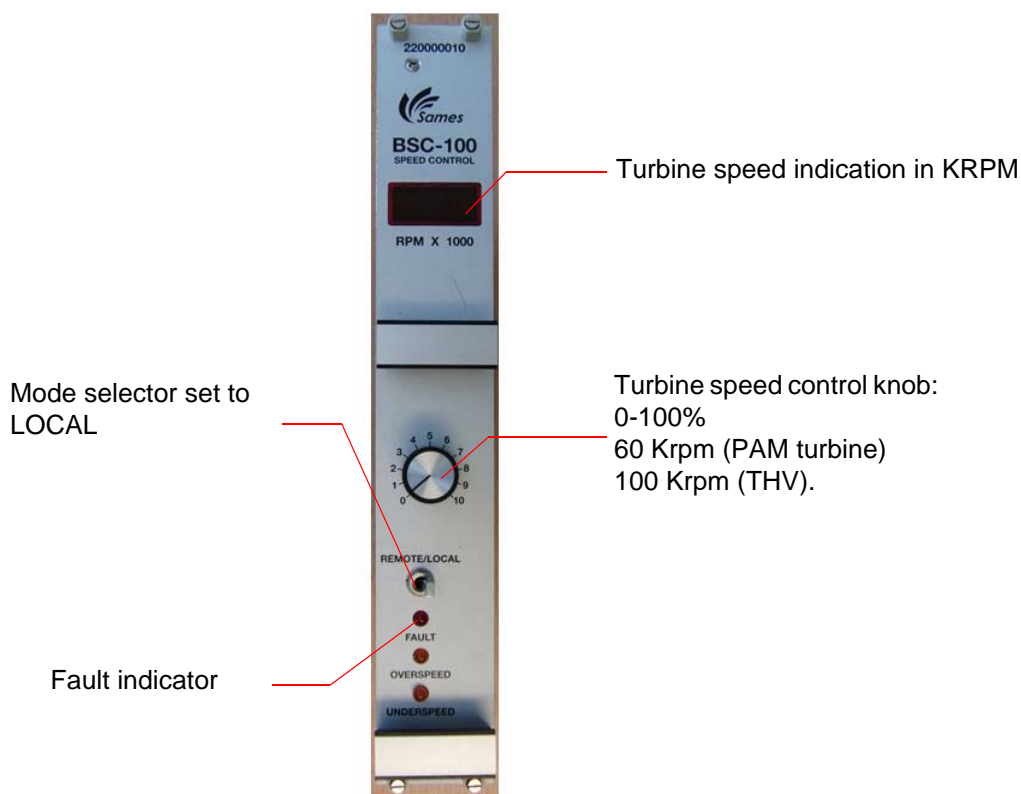
If the high voltage unit is indeed connected to the GNM200, no fault will exist for the GNM200, the
the SBOX-BELL module will be ready to operate based on the different operating modes.

3.3. Local mode

The "**Local/Remote**" selector for the SLR module must be set to "**Local**", leaving the operator with access to the different orders of the 5-position selector on the **SBOX-BELL module.**

0	STOP	STOP mode
1		Spraying mode
2		Head rinsing mode
3		Circuit rinsing mode
4		Circuit dump mode

3.3.1. Spraying mode

1		Spraying mode

A spraying request is taken into consideration if:
- **the turbine rotation speed exceeds the configured minimum threshold** (<u>see § 2.5.4 page 16</u>).
- no fault exists for the SBOX-BELL module.
- if an PFS module is used, **if this module enables the request**.

The green mode indicator (light switch on the SLR module) will then light up.

And if:
- the conveyor is operating
- a part is present in the paint zone (or the part sensor is not used, i.e terminals XC1 9 &11 are shunted)

Then spraying will start:
- Activation of output 51.
- Activation of the HV trigger of the GNM200.

3.3.2. Head rinsing

2		Head rinsing mode

In this mode, the inside and outside of the bell cup are cleaned, using a dedicated circuit.
A head rinsing request is taken into consideration if:
- the turbine rotation speed exceeds the configured minimum threshold (see § 2.5.4 page 16).
- if an PFS module is used, **if this module enables the request**.
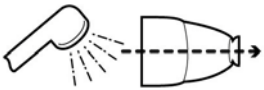
The green mode validation indicator (on the SLR module) is then activated, the pneumatic outlet 56 / 58 is activated (pneumatic inlets 56 and/ or 58 on the sprayer)
During this sequence, the operator may opt to use solvent (outlet 536) or air (528) for rinsing purposes (if the circuits are physically present), via the switch on the front panel:

AIR   0   GROUND
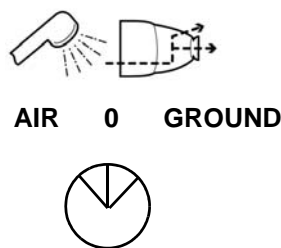
The duration of the rinsing cycles then depends on the operator, a air-solvent-air series lasting just a few seconds will generally be adequate for rinsing purposes.

3.3.3. Circuit rinsing

3		Filling / Circuit rinsing mode

In this mode, the spraying circuit is cleaned. This circuit must be cleaned at the end of production or before the color is changed.
A circuit rinsing mode request is taken into consideration, **if**:
- the turbine rotation speed exceeds the configured minimum threshold (see § 2.5.4 page 16).
- if an PFS module is used, **if this module enables the request**.
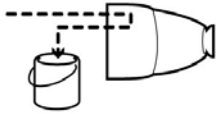
The green mode validation indicator (on the SLR) lights up, and the pneumatic outlet 51 is activated.
This mode can also be used to load the circuit with paint prior to spraying (see § 6.6.4 page 54).

3.3.4. Circuit dump

4		Circuit dump mode

In this mode, the paint circuit is cleaned, if product must be recovered. This circuit must be cleaned at the end of production or before the color is changed.

A circuit dump mode request is taken into consideration, if:
- if an PFS module is used, **if this module enables the request**.

The green mode validation indicator (on the SLR module) lights up, and the pneumatic outlet 53 is activated.

3.3.5. YV 51 forcing - flow measurement

⚠️

WARNING : The operator is entirely liable for use of this mode.
This mode was defined to measure the real flowrate of the paint in the system in a given configuration.
This operation must be carried out by qualified personnel, aware of the specific nature of the process (downgraded safety).

A security key selector N°458 A*(2 keys) can be found on each SBOX-BELL module within the pack or panel. This key forces the product valve to open (YV51).

This action is only possible in **LOCAL** mode on the SLR module and in **STOP** mode on the SBOX-BELL. The selected mode will be forced to STOP in all other cases.

Applicable precautions:
- Do not cut off the general air supply.
- Change the turbine sequence (switch to "**Remote**" mode on the turbine speed control card)
- Set shaping air, bearing air and microphone air to 0 bar
- Remove the bell cup from the sprayer using the appropriate tool
- Position the security key. *YV 51 forcing*

The SLR module does not take into consideration safety devices (bearing air, minimum turbine speed threshold, bell cup air feedback). Measurements can be taken:
- using the paint flow control pressure regulator on the front panel of the SBOX-BELL modules
- using a manual setpoint on the GPC module
- by controlling a value on the PFS module and other product supplies.

YV51 forcing selector with security key 458

3.4. REMOTE mode

In remote mode (selected using the SLR module), spraying and high voltage trigger controls are managed on the basis of external orders.

During the switch to remote mode, if:
- the turbine rotation speed exceeds the configured minimum threshold
- no fault exists for the SBOX-BELL module
- if an PFS module is used, **if this module enables the request**.

In this case, the green mode indicator (SLR module) will light up

And if:
- the conveyor is operating
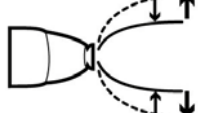
Then spraying can start:
- Activation of output 51, in case of an external spraying request.
- Activation of the high voltage trigger of the GNM200, if an external high voltage trigger request is received.

This remote control mode can therefore be used both to spray parts (Paint + HV), and for rinsing and to fill the circuit (paint only).
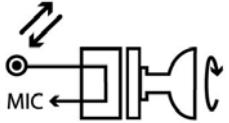
Note: the conveyor must run at all times during these operations.

3.5. Settings

Pressure regulator located on the front panel of the module to be set according to the application.

	Product / paint flow setting. Regulator control air – paint Supplied with 20A pressure Setting from 0 to 6 bar
	Adjustment of the form of the paint spray. Shaping air Supplied with 20 A pressure Setting from 0 to 6 bar

Pressure regulator located on the rear panel, setting defined at installation

	Adjustment of microphone air. Air for microphone signal feedback, used to regulate turbine speed. Supplied with 20A pressure Setting from 1 to 2 bar
	Adjustment of bearing air. Turbine rotation magnetic bearing air Supplied with 20B pressure Setting 5.5 bar or higher

Pressure switches at the rear of the SBOX module

SP23	Indication and trigger threshold for bearing air pressure. Threshold: 4.5 bar with time delay of 1s, to avoid any spurious activation
SP83	Indication and trigger threshold for bell cup detection air pressure. Threshold: 1.5 bar.

GNM 200 control module, <u>see RT Nr 6213</u>

Turbine speed control card BSC 100 <u>see RT Nr 6423</u>
The card is configured as follows:
- 0-60 Krpm, for sprayers with a turbine with magnetic bearings (PAM).
- 0-100 Krpm, for sprayers with a high-speed turbine (THV).

3.6. Faults

Description	Conditions	Actions	Remark
Bearing air detection fault	No bearing air for the S-BOX	Shutdown	Fault indicated by the pressure switch SP23, at the back side of the S-BOX. The LED OU1 must normally be activated. Setting threshold = 4.5 bar
GNM fault	Fault on the GNM module, red LED activated on the GNM.	Spraying and HV stop Red indicator on the SLR module	In the water-based version, on the slave S-BOX BELL this fault is not taken into account, it is linked electrically.
Turbine speed control card fault	Turbine speed card fault, red LED activated on the card	Spraying and HV stop Red indicator on the SLR module	
Bell cup detection fault	No bell cup on the sprayer (mainly used with PPH707)	Spraying and HV stop Red indicator on the SLR module	Fault indicated by the pressure switch SP83, at the back side of the SBOX module. The LED OU1 must normally be activated. Setting threshold = 1.5 bar. The pressure switch is live if the GNM and the turbine speed rotation card report no fault. If the sprayer cannot indicate the presence of the BELL CUP, CC pressure must be applied to pneumatic inlet 83.

⚠️

WARNING : Spraying (activation of valve YV51) is only possible if the turbine speed exceeds the threshold configured. If the speed is below this threshold, this is not a fault (the red indicator is not activated), and this information is not saved.

4. Operation of the SBOX-2-GUN module

Master S-BOX-Gun module

Mode selector

Master

GNM 200

OFF

1 or
2 TRP selector

Pressure regulator
for paint flow

Pressure regulator
for atomizing air
flow

SAMES KREMLIN

S-BOX
GUN

Pressure regulator
for fan air flow

Slave SBOX-Gun module

1 or 2 TRP selector

Slave

GNM 200
(or not for
water-
based
version)

0   1   OFF
1: Master
- Slave

SBOX-2GUN
selector

SAMES KREMLIN
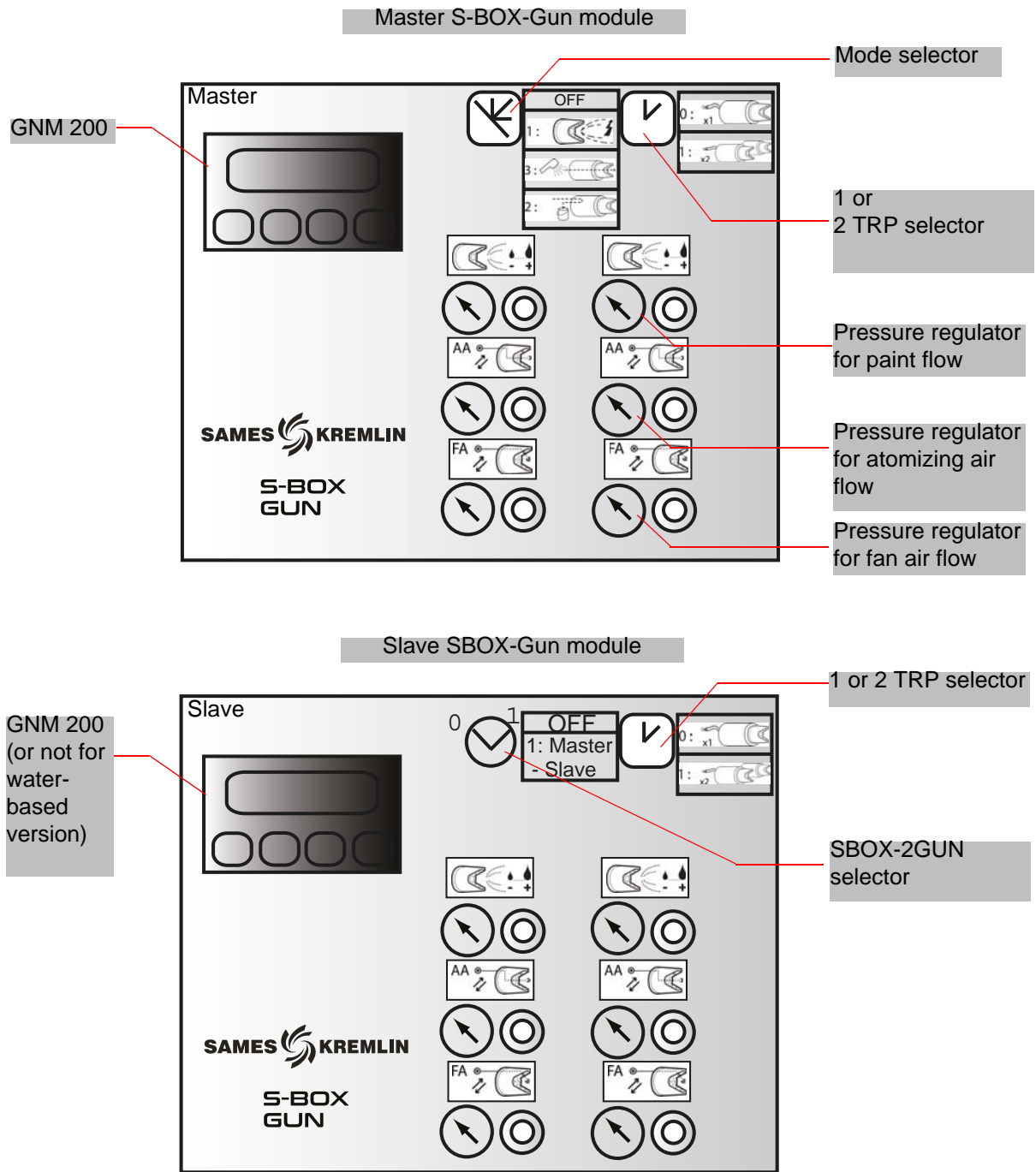
S-BOX
GUN

4.1. One S-BOX-2-GUN module or 2 S-BOX-2-GUN modules

If two SBOX-2-GUN modules are used, the first SBOX-2-GUN is considered as the master SBOX-2-GUN, and the second as the slave SBOX-2-GUN.
In fact, the local operating modes (Spray - Circuit rinsing – Dump) are identical for the 2 SBOX-2-GUN, and are indicated by the master SBOX-2-GUN. The slave SBOX-2-GUN can be deactivated (mode selector set to STOP).
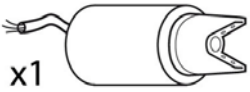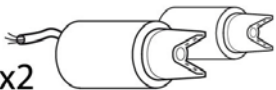
4.2. Start-up

The SBOX-2-GUN module is started using the SLR module.
When the SBOX-2-GUN is operating, the GNM 200 is live, and pressurised (20A).
The S-BOX-2-GUN module can be used with two electropneumatic guns.
The selector can be used to confirm the control of the 2nd gun:
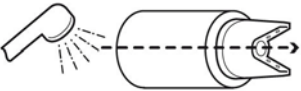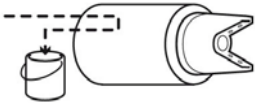
0		Use of one single gun
1		Use of the two guns

4.3. Operating modes

0	STOP	STOP mode
1		Spraying mode
2		Circuit rinsing mode
3		Circuit dump mode

4.3.1. Spraying

1		Spraying mode

A spraying request is taken into consideration if:
- no fault exists for the SBOX-2-GUN module.
- if an PFS module is used, **if this module enables the request**.

The green mode indicator (light switch on the SLR module) will then light up,
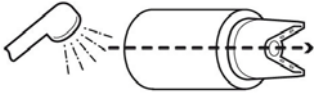
And if:
- the conveyor is operating
- a part is present in the paint zone (or the part sensor is not used, i.e. terminals XC1 9 &11 are shunted)

Then spraying will start:
- Activation of output PT1 (and/or PT2).
- Activation of the HV trigger of the GNM200.

4.3.2. Circuit rinsing

2		Circuit rinsing mode

In this mode, the paint circuit is cleaned. This circuit must be cleaned at the end of production or before the color is changed.

A circuit rinsing mode request is taken into consideration, if:
- if an PFS module is used, **if this module enables the request**.

In this case, the green mode validation indicator (on the SLR module) will light up. The pneumatic output PT1 (and/or PT2) will be activated,

This mode can also be used to load the circuit with paint prior to spraying ()

4.3.3. Circuit dump

3		Circuit dump mode

In this mode, the paint circuit is cleaned, if product must be recovered. This circuit must be cleaned at the end of production or before the color is changed.

A circuit rinsing mode request is taken into consideration, if:
- if an PFS module is used, **if this module enables the request**.

In this case, the green mode validation indicator (on the SLR module) will light up. The pneumatic output PD1 (and/or PD2) will be activated.

4.3.4. Flow measurement

To measure paint flow, simply select circuit rinsing mode.
Measurements can be taken:
- using the paint flow control pressure regulator located on the front panel of the SBOX-2-GUN modules.
- using a manual setpoint on the GPC.
- by controlling a value on the PFS and other product supplies.

4.3.5. REMOTE mode

In remote mode (selected using the SLR module), spray and high voltage trigger controls are managed on the basis of external orders.

During the switch to remote mode, if:
- no fault exists for the SBOX-2-GUN module
- if an PFS module is used, **if this module enables the request**.

In this case, the green mode indicator (SLR module) will light up
And if:
- **the conveyor is operating**
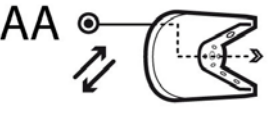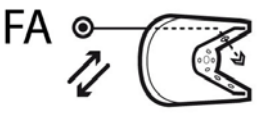
Then spraying can start:
- Activation of output PT1 (and/or PT2), in case of an external spraying request.
- Activation of the HV trigger of the GNM200, if an external HV trigger request is received.

This remote control mode can therefore be used both to spray parts (Paint + HV), and for rinsing and to fill the circuit (paint only).
Remark: however the conveyor must be running during these operations.

4.4. Settings

Pressure regulator located on the front panel of the module to be set on the basis of the application.

	Product/paint air flow setting. Regulator control air – paint Supplied with 20A pressure Setting from 0 to 6 bar
AA	Adjustment of the form of the centre of the paint spray - Atomizing air Supplied with 20A pressure Setting from 0 to 6 bar
FA	Adjustment of the form of the outer part of the paint spray - Fan air. Supplied with 20A pressure Setting from 0 to 6 bar

Pressure regulator located on the rear panel, to be adjusted based on site configuration (distance between the SBOX-2-GUN and the gun and system pressure)

TRIGGER CONTROL AIR PRESSURE 5 bar	Adjustment of the control air pressure for the gun needle valve Supplied with 20A pressure Setting to ensure 5 bar or less at the gun control inlet

4.5. Faults

Description	Conditions	Actions	Remark
GNM fault	Fault on the GNM module, red LED activated on the GNM.	Spraying and HV stop Red indicator on the SLR module	In the water-based version, on the slave S-BOX GUN this fault is not taken into account, it is linked electrically..

5. Operating principle with the GPC module (Gear Pump Controller)

The GPC module is used to manage two gear pumps.
Configuration (minimum):
- Type of circuit (with or without feedback)
- Flow setpoint in spraying mode
- Flow setpoint in rinsing and dump mode

Operating mode:
The GPC module must normally operate in LOCAL/ AUTOMATIC mode.
The SLR securities are only active in the automatic mode.
After start-up, the run command is done directly on the GPC module.
The flow setpoints are then applied directly according the SLR operating mode (spraying-rinsing-dump).
Spraying phases will stop in the event of a module fault.

5.1. Overview

SLR Module interface

Power supply

230 Vac ph+N - Compressed air

Controls / Information

- Spraying 1 and 2
- Dump 1 and 2
- Rinsing circuit

- GPC fault
- Pump feedback for PFS module

GPC module

Control panel:
Control of 2 gear pumps

Pump 1
- 3x 230 Vac supply from the speed controller.

- Motor fault temperature sensor

Pump 2
- 3x 230 Vac supply from the speed controller.

- Motor fault temperature sensor

5.2. Power up

The GPC module is supplied with 230 Vac when the SLR module is operating.
The internal 24 VDC supply is operational and the control display is active.

5.3. Operating mode

The GPC module is controlled using the touch screen, and the human-machine interface (HMI).
4 operating modes are available for each pump:
- STOP
- MANUAL
- AUTOMATIC
- REMOTE

5.4. Main interfaces

5.5. Operating logic

Automatic mode	Manual mode	Remote mode

Local order (HMI)	Local order (HMI)	Remote order
Flow setpoint pre-set locally (HMI) according to the S Box mode: - Spraying - Rinsing - Dump	Flow setpoint adjusted locally (HMI)	- Pump operation - Flow setpoint

Circuit configuration:

- With a recirculation 3-way valve: the pump operates at all times.
- Without a recirculation 3-way valve: the pump only operates if spraying, rinsing or dump is active

5.6. HMI screens

5.6.1. Main screen
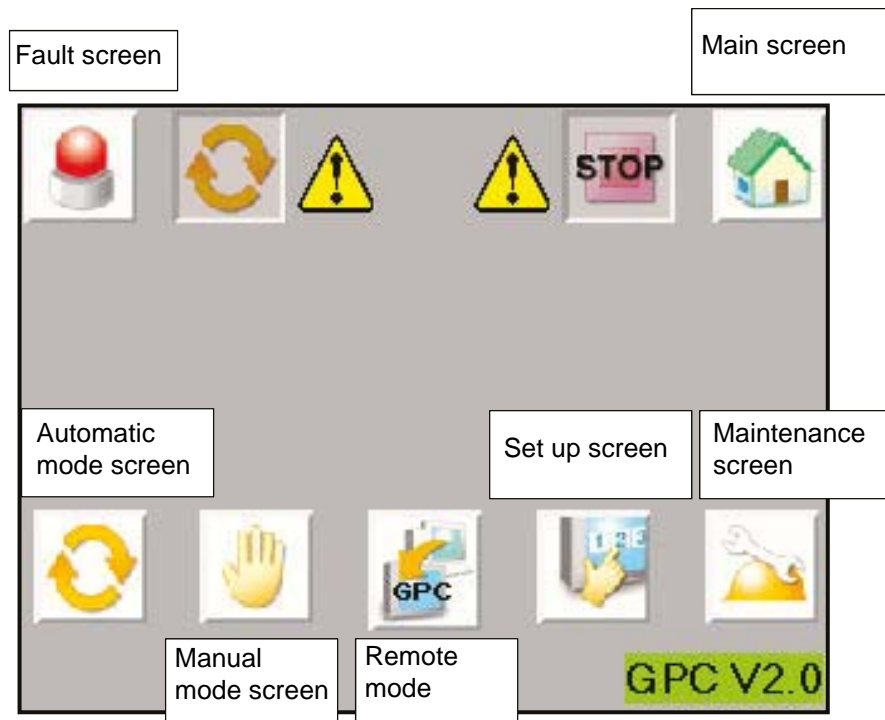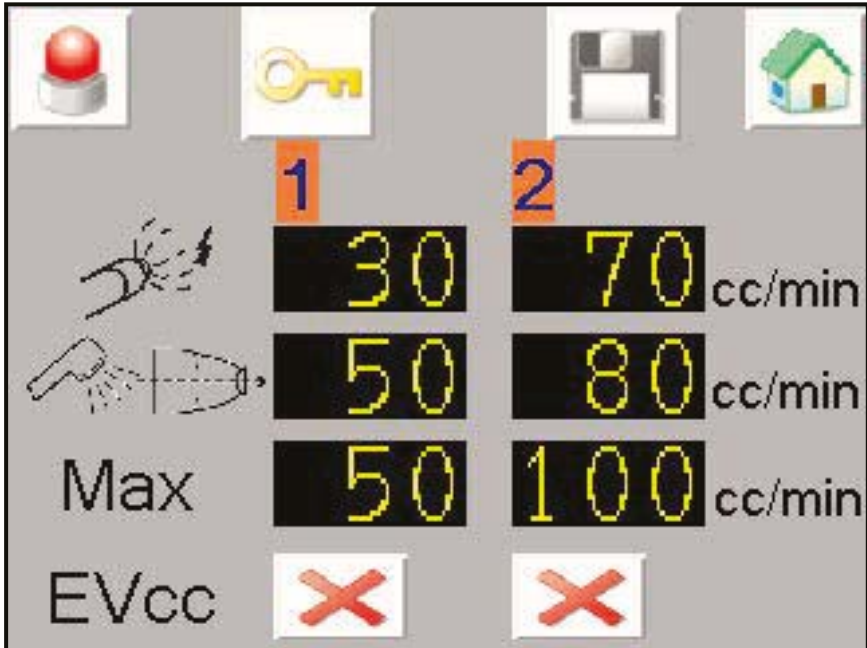
The top banner is common to several screens.
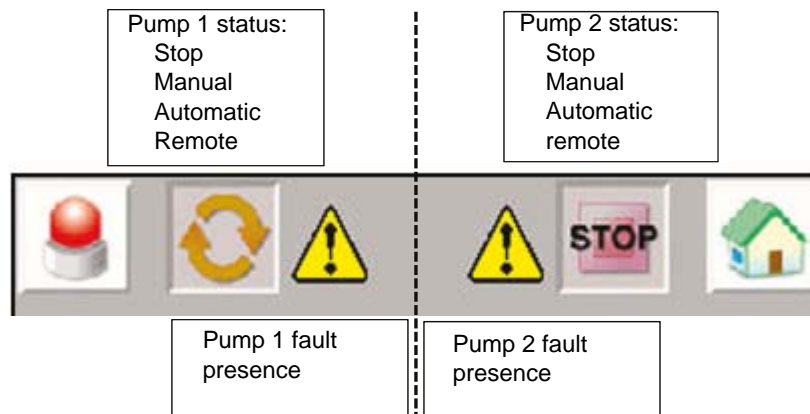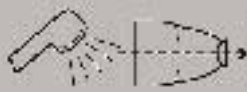
5.6.2. Setup screen

| Access to the unlocking window | Saving setup after modification |

	Spraying pump flow set-point in automatic mode (0- Max)
	Rinsing/dump flow set-point in automatic mode (0- Max)
	Maximum pump (0-999)
	Presence of a recirculation 3-way valve

Access to the unlocking window:

| To change the setup a password must be entered. |
| User ID: ADMIN |
| Password: ADMIN |
| When access is allowed the key is no longer crossed out. barrée. |

Access is allowed for a few minutes, even if the user changes of screen.

5.6.3. Manual mode screen

Status return of pump 1 mode

Status return of pump 2 mode

Pump 1 validation in manual

Pump 2 validation in manual

Pump flow setpoint

Curent flow value for each pump

cc/min

cc/min

cc/min

cc/min
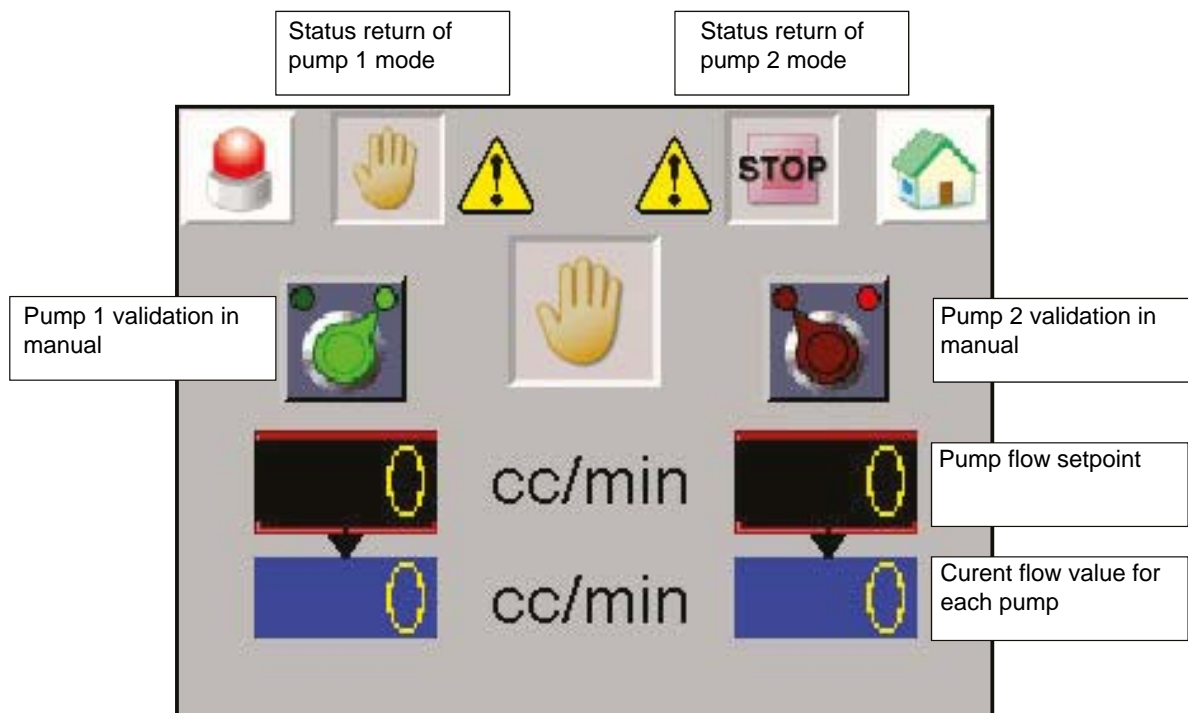
To enable the manual mode, the pump must be first in STOP mode.
The pump stops in case of fault, it will reset when the fault is acknowledged.

The pump will operate when the mode is enabled.
The flow setpoint applied is that directly entered on the screen in cc/min.
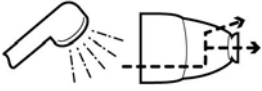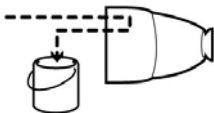
Warning: the manual mode does not take into account the SLR securities.

5.6.4. Automatic mode screen

Status return of pump 1 mode

Status return of pump 2 mode

Pump 1 validation in automatic

Pump 2 validation in automatic

Circuit status indicator

Current flow value for each pump
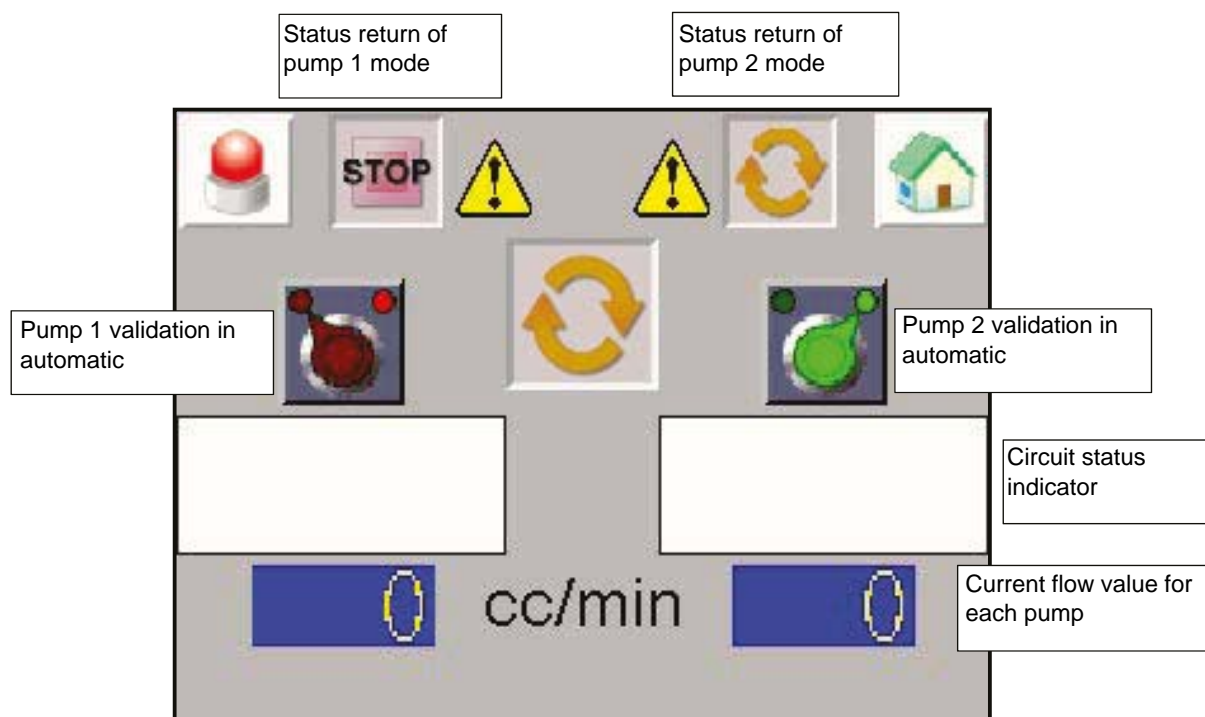
To enable the automatic mode, the pump must be first in STOP mode.
The pump stops in case of fault, it will reset when the fault is acknowledged.

Circuit status indicator

	Spraying Applied flow: spraying setpoint in setup screen
	Rinsing Applied flow: rinsing setpoint in setup screen
	Dump Applied flow: rinsing setpoint in setup screen
	STOP If the 3-way valve EV CC is enabled : the spraying flow is applied . If the 3-way valve EV CC is not enabled : the flow is equal to 0 the pump is stopped

5.6.5. Remote mode screen

Status return of pump 1 mode

Status return of pump 2 mode

Remote operating state pump 1

Pump 2 validation in remote

Pump 1 validation in remote

Remote operating state pump 2

Requested flow setpoint in remote

Current flow value for each pump
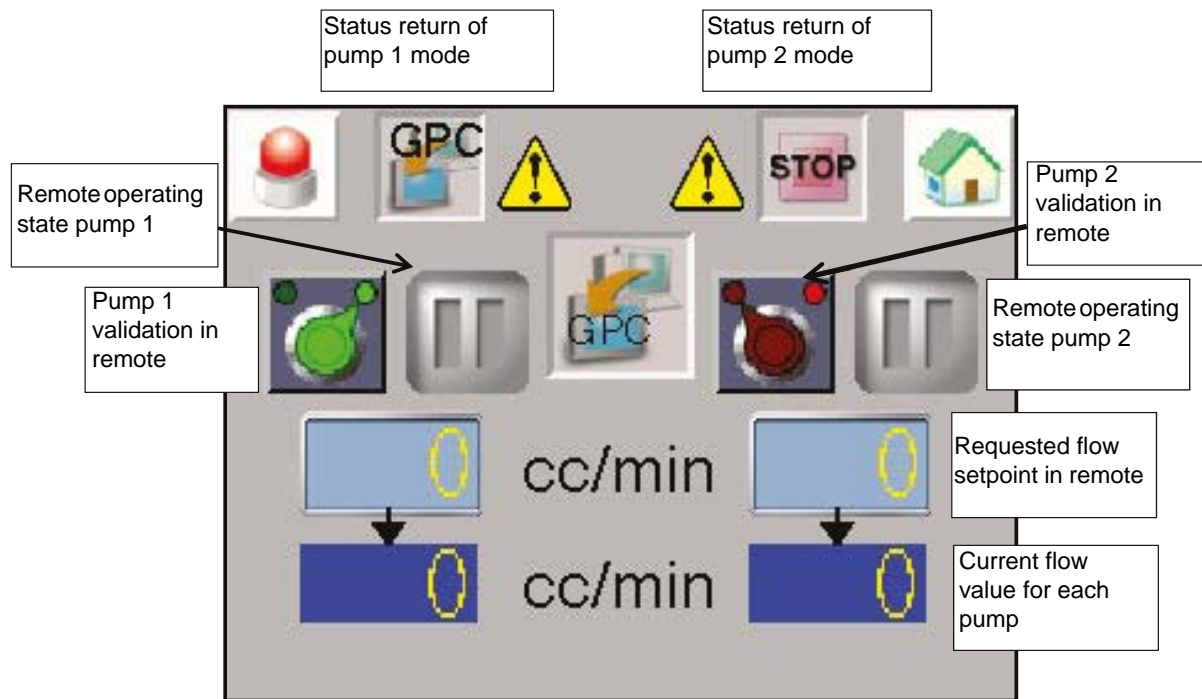
To enable the remote mode, the pump must be first in STOP mode.
The pump stops in case of fault, it will reset when the fault is acknowledged.

The pump will operate on external command (XC2 connector).The flow setpoint applied corresponds to the 0-10V external signal (XC2 connector)
10V corresponds to 100% of the maximum flow.

⚠️
WARNING : The remote mode does not take into account the SLR securities.

5.6.6. Maintenance
Display of the states of each digital input/output of the variable speed drives.

Motor thermal sensor OK	Thermal_sens
Spraying requested from SLR	Spray
Remote run order	Remote_run
Dump requested from SLR	Dump
Rinsing requested from SLR	Rinsing
Pump drive in fault	Pump_DEF
Pump is running	Pump_ON
Pump run requested	Run_Pump

By pressing the drive image, it is possible to visualize and modify (with the same password as in setting mode) some parameters of the drives.

Access to the unlocking window

Saving after modifications

	PLC cycle time
Acc / Sec	Acceleration ramp By default 0.5 s
Dec \ Sec	Deceleration ramp By default 0.2 s
Current A	Motor nominal current By default 1.3 A
Speed rpm	Motor nominal speed By default 1425 rpm
Cos φ	Motor power factor By default 0.77 A

5.6.7. Fault screen

Drive state
Fault if there is a triangle

Error code of the last fault appeared:
refer to the list of codes below.

Acknowledge of fault
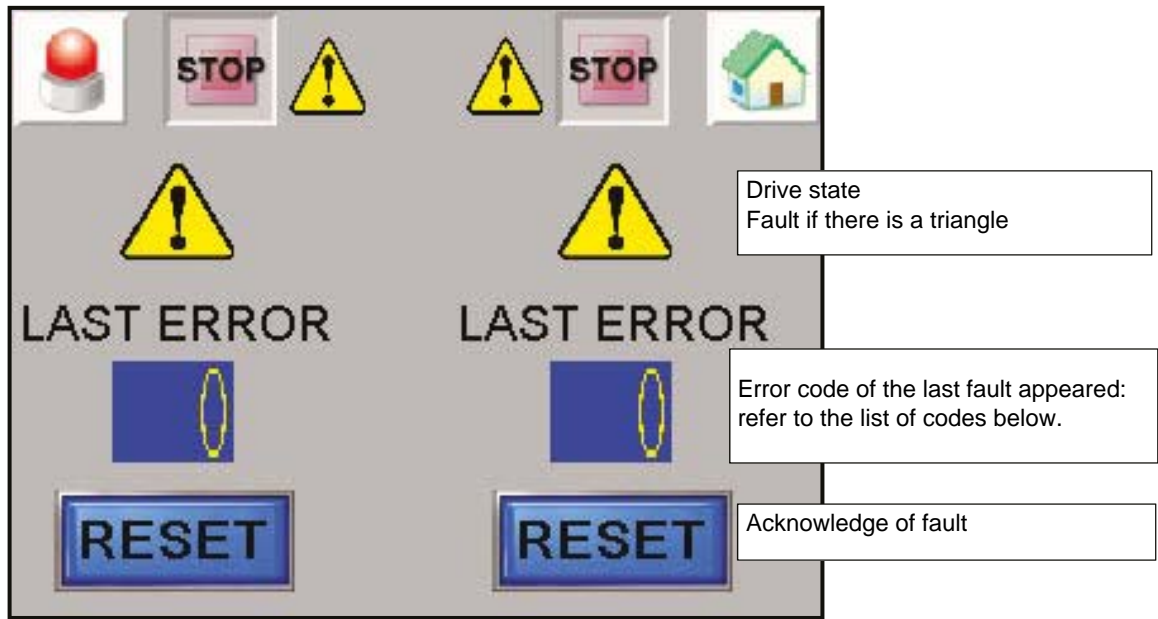
Liste of error codes for the drive.

Remarks: Code No. 6 corresponds to a fault of the thermal sensor, and code 33 corresponds to a motor not connected

N°	Code	State	Possible Cause and recommended action
1	rES	Spare	
2	OV	DC bus voltage has exceeded the peak level or maximum continuous level for 15 seconds	• Increase deceleration ramp • Check motor insulation using a insulation tester
3	OI.AC	Instantaneous output over current detected	• Increase acceleration/deceleration rate • Check for short circuit on the output cabling • Check integrity of the motor insulation using an insulation tester
4	OI.br	Braking IGBT over current detected: short circuit protection for the braking IGBT activated	over current has been detected in braking IGBT or braking IGBT protection has been activated
5	PSU	Internal power supply fault	There is a hardware fault within the drive – return the drive to the supplier
6	Et	An External trip is initiated	• Check motor temperature • Check the thermal sensor.
7	O.SPd	Motor frequency has exceeded the over frequency threshold	Check that a mechanical load is not driving motor
8	U.OI	User OI ac	the output current of the drive exceeds the trip level
9	rES	Spare	
10	th.br	Brake resistor over temperature	• Check brake resistor wiring • Check braking resistor value is greater than or equal to the minimum resistance value • Check braking resistor insulation
11-12	rES	Spare	
13	tunE	Measured inertia has exceeded the parameter range	The drive has tripped during a rotating autotune or mechanical load measurement test. Check motor cable wiring is correct
14-17	rES	Spare	
18	tunS	Autotune test stopped before completion	The drive was prevented from completing an autotune test, because either the drive enable or the drive run were removed. Check the drive enable signal (Terminal 11) was active during the autotune
19	It.br	Braking resistor overload timed out (I2t)	
20	It.aC	Output current overload timed out (I2t)	• Ensure the load is not jammed / sticking • Check the load on the motor has not changed • Tune the motor rated speed parameter (Pr 5.008) (RFC-A mode only) • Ensure the motor rated current is not zero

21	O.htI	Inverter over temperature based on thermal model	An IGBT junction over-temperature has been detected based on a software thermal model • Increase acceleration / deceleration rates • Reduce motor load • Check DC bus ripple • Ensure all three input phases are present and balanced
22	O.htP	Power stage over temperature	• Check enclosure / drive fans are still functioning correctly • Force the heatsink fans to run at maximum speed • Check enclosure ventilation paths • Check enclosure door filters • Increase ventilation • Reduce the drive switching frequency • Reduce duty cycle • Increase acceleration / deceleration rates • Reduce motor load
23	rES	Spare	
24	th	Motor thermistor over-temperature	
25	thS	Motor thermistor short circuit	
26	O.Ld1	Digital output overload	The total current drawn from 24 V user supply or from the digital output has exceeded the limit (Maximum output current from one digital output is 100 mA.) • Check total loads on digital outputs • Check control wiring is correct • Check output wiring is undamaged
27	Oh.dc	DC bus over temperature	A DC bus component over temperature based on a software thermal model. • Check the AC supply voltage balance and levels • Check DC bus ripple level • Reduce duty cycle • Reduce motor load • Check the output current stability. If unstable; Check the motor map settings with motor nameplate
28	cL.A1	Analog input 1 current loss1	The *cL.A1* trip indicates that a current loss was detected in current mode on Analog input 1 (Terminal 2).
29	rES	Spare	
30	SCL	Control word watchdog has timed out	
31	EEF	Default parameters have been loaded	Default parameters have been loaded • Default the drive and perform a reset • Allow sufficient time to perform a save before the supply to the drive is removed • If the trip persists - return drive to supplier
32	Ph.Lo	Supply phase loss	• Check the AC supply voltage balance and level at full load • Check the DC bus ripple level with an isolated oscilloscope • Check the output current stability • Reduce the duty cycle • Reduce the motor load

33	rS	Measured resistance has exceeded the parameter range	• Check the motor cable / connections • Check the integrity of the motor stator winding • Check the motor phase to phase resistance at the drive and motor terminals • Ensure the stator resistance of the motor falls within the range of the drive model
34	Pad	Keypad has been removed when the drive is receiving the reference from the keypad	
35	CL.bt	Trip initiated from the *Control Word* (06.042)	
36	U.S	User Save error / not completed	• Perform a user save in Pr mm.000 to ensure that the trip doesn't occur the next time the drive is powered up. • Ensure that the drive has enough time to complete the save before removing the power to the drive.
37	Pd.S	Power down save error	• Perform a 1001 save in Pr mm.000 to ensure that the trip doesn't occur the next time the drive is powered up.
38-39	rES	Spare	
90	LF.Er	Communication has been lost / errors detected between power, control and rectifier modules	• Hardware fault - contact the supplier of the drive.
91	US.24	User 24 V supply is not present on the adaptor interface terminals (1,2)	• Ensure the user 24 V supply is present on the user terminals on the adaptor interface.
92	OI.Sn	Snubber over-current detected	• Ensure the internal EMC filter is installed • Ensure the motor cable length does not exceed the maximum for selected switching frequency • Check for supply voltage imbalance • Check for supply disturbance such as notching from a DC drive • Check the motor and motor cable insulation with a Megger • Install a output line reactor or sinusoidal filter
93	Pb.Er	Communication has been lost / errors detected between power control	• Hardware fault – Contact the supplier of the drive
94-96	rES	Spare	
97	d.Ch	Drive parameters are being changed	• Ensure the drive is not enabled when defaults are being loaded
98	Out.P	Output phase loss detected	• Check motor and drive connections
99	rES	Spare	
100	rESEt	Reset drive	
101	Oh.br	Braking IGBT over-temperature	• Check braking resistor value is greater than or equal to the minimum resistance value

102	Oht.r	Rectifier over temperature	• Check the motor and motor cable insulation with an insulation tester • Fit an output line reactor or sinusoidal filter • Force the heatsink fans to run at maximum speed by setting Pr 06.045 = 1 • Check enclosure / drive fans are still functioning correctly • Check enclosure ventilation paths • Increase acceleration / deceleration rates • Reduce duty cycle • Reduce motor load
103-108	rES	Spare	
109	OI.dc	Power module over current detected from IGBT on state voltage monitoring	The short circuit protection for the drive output stage has been activated. • Disconnect the motor cable at the drive end and check the motor and cable insulation with an insulation tester • Replace the drive
110-172	rES	Spare	
173	FAN.F	Fan fail	• Check that the fan is fitted and connected correctly. • Check that the fan is not obstructed. • Contact the supplier of the drive to replace the fan
174	C.SI	NV Media Card trip; Option module file transfer has failed	
175	C.Pr	NV Media Card data blocks are not compatible with the drive derivative	
176	rES	Spare	
177	C.bt	The Menu 0 parameter modification cannot be saved to the NV Media Card	
178	C.by	NV Media Card cannot be accessed as it is being accessed by an option module	
179	C.d.E	NV Media Card data location already contains data	
180	C.OPt	NV Media Card trip; option modules installed are different between source drive and destination drive	
181	C.rdo	NV Media Card has the Read Only bit set	
182	C.Err	NV Media Card data structure error	
183	C.dAT	NV Media Card data not found	
184	C.Ful	NV Media Card full	
185	C.Acc	NV Media Card Write fail	
186	C.rtg	NV Media Card Trip; The voltage and / or current rating of the source and destination drives are different	

187	C.tyP	NV Media Card parameter set not compatible with current drive mode	
188	C.cPR	NV Media Card file/data is different to the one in the drive	
189	OI.A1	Analog input 1 over-current	Current input on analog input 1 exceeds 24mA.
190-198	rES	Spare	
199	dESt	Two or more parameters are writing to the same destination parameter.	• Set Pr mm.000 to 'Destinations' or 12001 and check all visible parameters in all menus for parameter write conflicts
200	SL.HF	Option module 1 hardware fault	• Ensure the option module is installed correctly • Replace the option module • Replace the drive
201	SL.To	Option module watchdog function service error	• Replace the option module
202	SL.Er	Option module in option slot 1 has detected a fault	
203	SL.Nf	Option module in option slot 1 has been removed	• Ensure the option module is installed correctly. • Re-install the option module. • To confirm that the removed option module is no longer required perform a save function in Pr mm.000.
204	SL.dF	Option module in option slot 1 has changed	• Turn off the power, ensure the correct option module is installed in the option slot and re-apply the power. • Confirm that the currently installed option module is correct, ensure option module parameters are set correctly and perform a user save in Pr mm.000.
205-214	rES	Spare	
215	OPt.d	Option module does not acknowledge during drive mode changeover	
217-216	rES	Spare	
218	tH.Fb	Internal thermistor has failed	Hardware fault – Contact the supplier of the drive
219	Oht.c	Control stage over-temperature	This trip indicates that a control stage over-temperature has been detected if Cooling Fan control (06.045) = 0. Increase ventilation by setting Cooling Fan control (06.045) > 0.
220	P.dAt	Power system configuration data error	Hardware fault – Contact the supplier of the drive
221	St.HF	Hardware trip has occurred during last power down	Enter 1299 in Pr mm.000 and press reset to clear the trip
222-224	rES	Spare	
225	Cur.O	Current feedback offset error	The current offset is too large to be trimmed. • Ensure that there is no possibility of current flowing in the output phases of the drive when the drive is not enabled • Hardware fault – Contact the supplier of the drive

226	So.St	Soft start relay failed to close, soft start monitor failed	Hardware fault – Contact the supplier of the drive
227	r.ALL	RAM allocation error	
228	OI.SC	Output phase short-circuit	Over-current detected on drive output when enabled. Possible motor earth fault. • Check for short circuit on the output cabling • Check integrity of the motor insulation using an insulation tester • Is the motor cable length within limits for the frame size?
229-230	rES	Spare	
231	Cur.c	Current calibration range	Current calibration range error.
232	dr.CF	Drive configuration	The hardware ID does not match the user software ID.
233-234	rES	Spare	
235	Pb.HF	Power board HF	• Hardware fault - Contact the supplier of the drive
236	No.PS	No power board	No communication between the power and control boards. • Check connection between power and control board.
237	FI.In	Firmware Incompatibility	The user firmware is incompatible with the power firmware. Re-program the drive with the latest version of the drive firmware for Unidrive M200.
238-244	rES	Spare	
245	Pb.bt	Power board is in bootloader mode	
246	*dEr.e*	*Derivative file error*	
247	Fi .ch	File changed	Power cycle the drive
248	dEr.l	Derivative product image error	Contact the supplier of the drive
249	rES	Spare	
250	r.b.ht	Hot rectifier/brake	Over-temperature detected on input rectifier or braking IGBT.
251-254	rES	Spare	
255	rSt.L		

6. Operating principle with the PFS module (Product Flush Selection)

The PFS module is used to manage changes in color for one or two circuits and up to 6 colors per circuit.

Configuration (minimum):
- Number of circuits (1 or 2).
- Number of colors per circuit (max. 6).
- Use of a gear pump or not.
- Time delay for rinsing, dump, head rinsing and filling sequences.

Operating mode:
The PFS module manages changes in color in semi-automatic mode.
The sequences used to change colors are started from the SBOX module and then conf¬irmed and processed by the PFS.
A manual mode exists and can be used to separate all sequences.
Spraying phases will stop in the event of a module fault.

6.1. Overview

SLR Module interface

Power supply

230 Vac ph+N - Compressed air

Controls / Information

- Spraying mode request
- Rinsing mode request
- Head rinsing mode request
- Circuit dump mode request

- PFS fault
- Mode OK (SLR feedback)

PFS module

Check based on the operator screen (HMI)
Circuit color change and rinsing sequence

Circuit 1

Solenoid valve control
- YV 528 bell rinsing air supply
- YV 536 bell rinsing solvent supply
- YV 5211 paint circuit air supply
- YV 533 paint circuit solvent supply
- YV 81.1 to select color 1
- YV 81.2 to select color 2
- YV 81.3 to select color 3
- YV 81.4 to select color 4
- YV 81.5 to select color 5
- YV 81.6 to select color 6

Circuit 2

Solenoid valve control
- YV 528 bell rinsing air supply
- YV 536 bell rinsing solvent supply
- YV 5211 paint circuit air supply
- YV 533 paint circuit solvent supply
- YV 81.1 to select color 1
- YV 81.2 to select color 2
- YV 81.3 to select color 3
- YV 81.4 to select color 4
- YV 81.5 to select color 5
- YV 81.6 to select color 6

6.2. POWER UP
The PFS module is supplied with 230 Vac when the SLR module is operating.
The internal 24 VDC supply is operational and the control display is active.
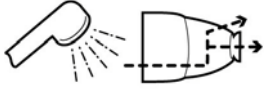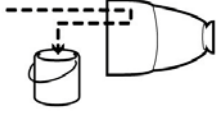
6.3. Operating modes
The PFS module is controlled using the touch screen, and the human-machine interface (HMI).
3 operating modes are available for each circuit:
  • STOP
  • MANUAL
  • AUTO

All operating orders are issued by the master SBOX.

  • In local mode   SLR   for the SLR module

0	STOP	STOP mode
1		Spraying mode
2		Head rinsing mode (SBOX-BELL)
3		Circuit rinsing mode
4		Circuit dump mode

  • In remote mode   SLR   for the SLR module

Valid for spraying requests only.

6.4. Main interfaces

Operating mode request authorisation

Mode request from the SLR
- Spraying
- Head rinsing (BELL)
- Circuit rinsing
- Circuit dump

Mode confirmation

Controlling color change and rinsing sequences

SAMES KREMLIN

SLR

SAMES KREMLIN

PFS

Mode authorisation
General fault

Mode request transmitted from the SBOX:
- Spraying
- Head rinsing (BELL)
- Circuit rinsing
- Circuit dump

Activation:
- Spraying: GNM-YV 51/PT
- Head rinsing: YV56 / 58 (BELL)
- Circuit rinsing: YV 51/PT
- Circuit dump: YV 53/PD

RCC1	
YV 528	YV 536
YV 5211	YV 533
YV 81.1	YV 81.2
YV 81.3	YV 81.4
YV 81.5	YV 81.6

SAMES KREMLIN

S-BOX BELL

STOP

Air 0 Sol

RCC2	
YV 528	YV 536
YV 5211	YV 533
YV 81.1	YV 81.2
YV 81.3	YV 81.4
YV 81.5	YV 81.6

6.5. Operating Logic

```
                              ┌─────────────────┐
                              │   STOP mode     │
                              │   no action     │
                              └─────────────────┘
        ┌───────────────────┐  ┌─────────────────┐
        │  Automatic mode   │  │  MANUAL mode    │
        │                   │  │  or Forçing mode│
        └───────────────────┘  └─────────────────┘
```

┌──────────────────────────┐   ┌──────────────────────────┐   ┌──────────────────────────┐
│ Spraying request from the │   │ **Manual mode**   │   │   Maintenance mode   │
│ master SBOX   │   │   │   └──────────────────────────┘
│   │   │ Operating order from the │
│ **In SLR local mode**:   │   │ master SBOX.   │
│ Selected color sprayed   │   │   │   ┌──────────────────────────┐
│ when the conveyor is ope- │   │ Validate the circuit(s) │   │ Display of all the control-│
│ rating and the part detec-│   │ concerned   │   │ ler's inputs and outputs │
│ tion conditions are OK   │   │ The SBOX makes a   │   │   │
│   │   │ request to the SLR which │   │ Possible forcing for cer- │
│ I**n SLR remote mode**:   │   │ makes a request to the   │   │ tains outputs   │
│ Selected color sprayed   │   │ PFS, which will authorise│   └──────────────────────────┘
│ when the conveyor is ope- │   │ the operator to launch the│
│ rating and a remote opera- │   │ sequence   │
│ ting order is received.   │   │   │
│   │   └──────────────────────────┘
│   │
│ **Cleaning** order from the│   ┌──────────────────────────┐
│ master SBOX   │   │ **Forcing mode**   │
│   │   │   │
│ **In SLR local mode**:   │   │ Accessible by the manual │
│ Cleaning sequences in as- │   │ mode view   │
│ sisted automatic mode: │   │   │
│ Circuit rinsing or dump   │   │ Local operating order   │
│ Head rinsing   │   │   │
│ Circuit filling   │   │ This mode is used for   │
│   │   │ example to calibrate the │
└──────────────────────────┘   │ paint flow for the system.│
                               └──────────────────────────┘

┌──┐
│ **Circuit configuration:**   │
│   │
│ If gear pumps are used, PFS module sequences will remain unchanged.│
│   │
│ Valves for circuit rinsing, circuit dump and circuit filling will only be controlled│
│ if the pumps are operating.   │
└──┘

6.6. HMI screens

6.6.1. Main screen

PFS mode active:
STOP
Manual
Color forcing
Automatic
Maintenance

Main screen

SV block communication state
PFS OK mode state

Com ✗
Mode ✗

STOP

Automatic
sequence screen

Configuration
screen

Maintenance
screen

Manual mode
screen

Parameter
screen

PFS V2.0

The strip at the top is common to several views

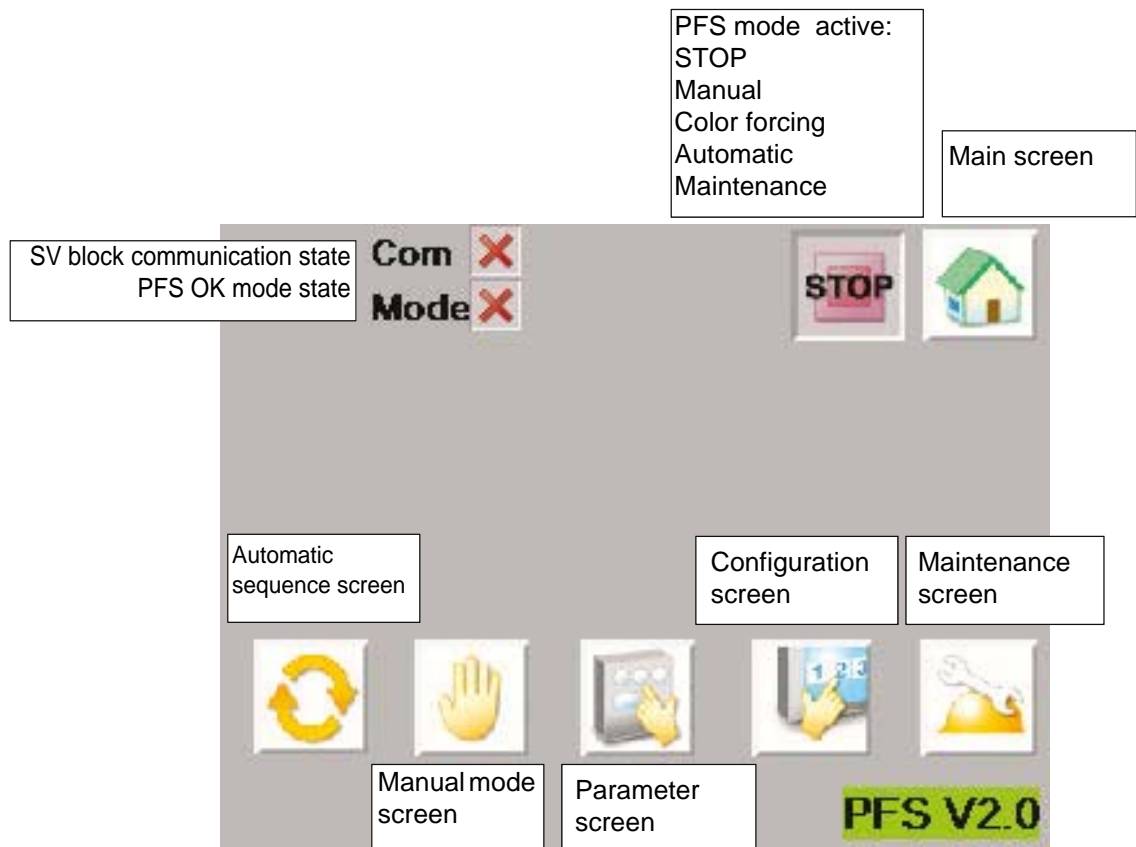If the communication state with the SV block is not operational (red cross), a fault is returned to the SLR to stop the spraying. You must check the communication on the SV block then restart the PFS module to initialise the communication.

The PFS OK mode turns green only when the operator validates a spraying or cleaning request from the SLR. This is the PFS authorisation image sent to the SLR module.

6.6.2. Configuration screen

To the unlocking screen

Validation of the circuit 2

Number of colors per circuit (1 to 6)

Validation of the head rinsing mode

Circuit gear pump present
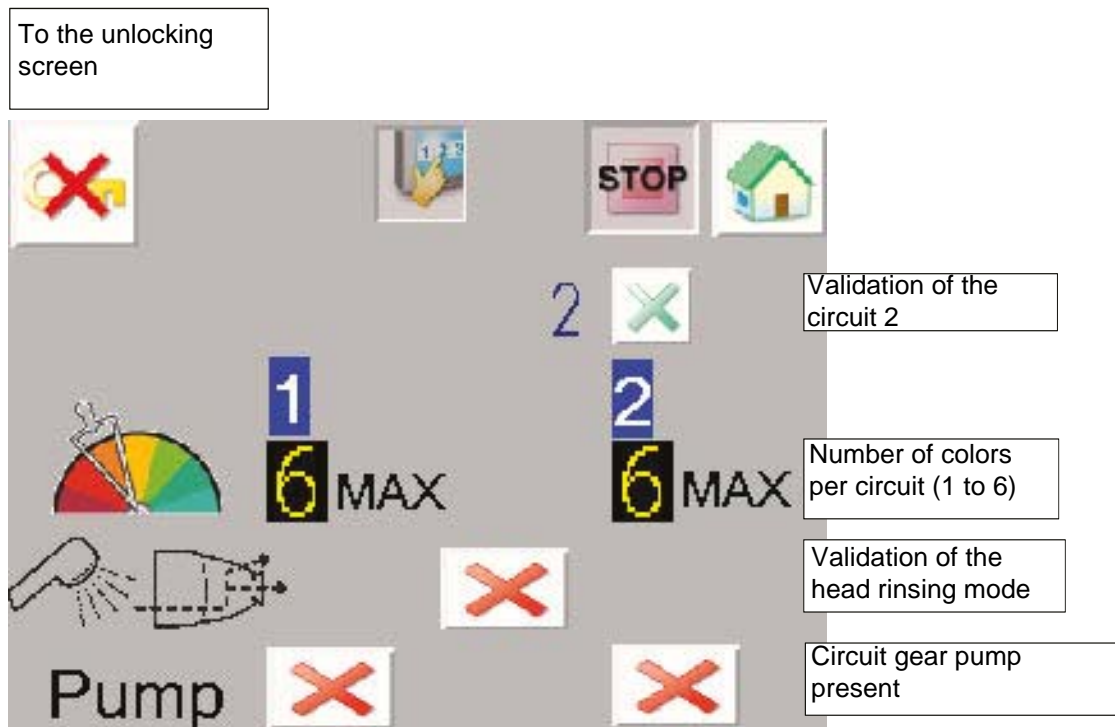
The operator must enter the system configuration in this screen:
- Number of circuits (1 or 2)
- Number of colors in circuit 1: 1 to 6
- Number of colors in circuit 2: 1 to 6
- Validation of the head rinsing mode: when it is validated, the head rinsing mode is requested by the automatic rinsing sequence (see § 6.6.6 page 56). With a SBOX-2-GUN module, this mode must not be validated.
- One gear pump present for each circuit or not.

Access to the unlocking window:
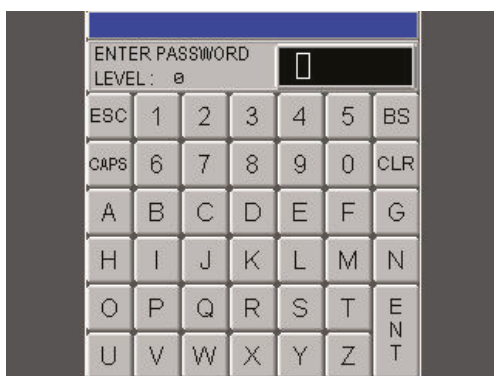
A password must be entered to modify the parameters.

Password: ADMIN (keyboard in upper case by default)

When access is authorised the key is no longer barred.

Access is authorised for a few minutes, even if the user changes view.

6.6.3. Parameters screen

Circuit 1

To parameters circuit 2

Circuit rinsing Solvent - air time delay
Circuit dump Solvent - air time delay
Head rinsing Solvent - air time delay
Circuit filling
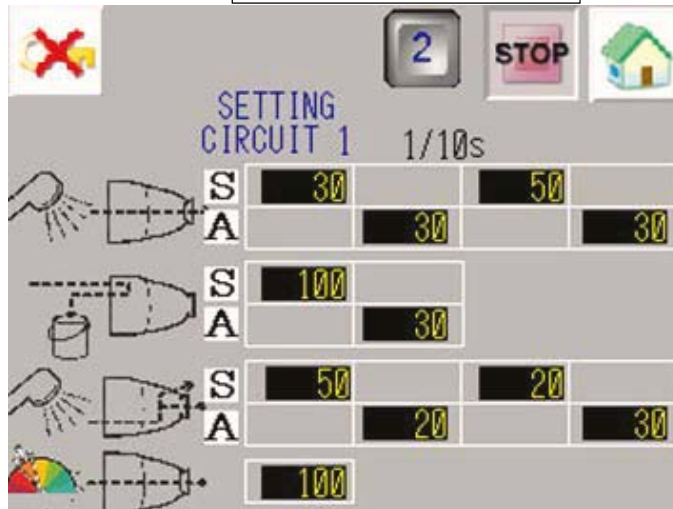
Circuit 2

Copy parameters circuit 1 to circuit 2	To parameters circuit 1

Circuit rinsing Solvent - air time delay
Circuit dump Solvent - air time delay
Head rinsing Solvent - air time delay
Circuit filling

Circuit rinsing sequence: YV 51 ON (or PT ON)

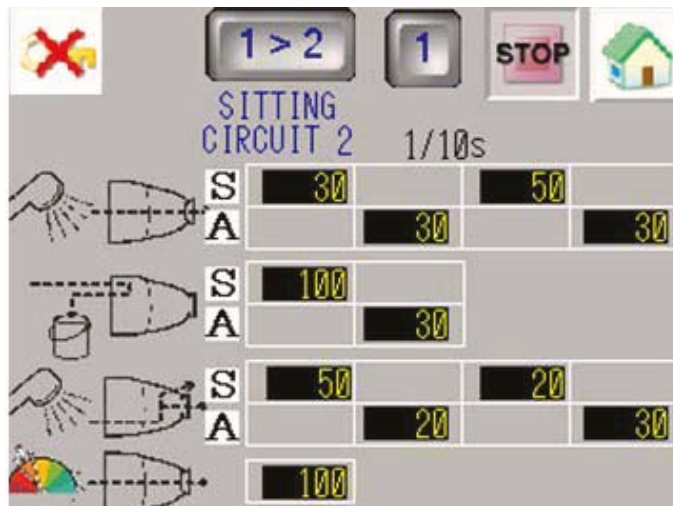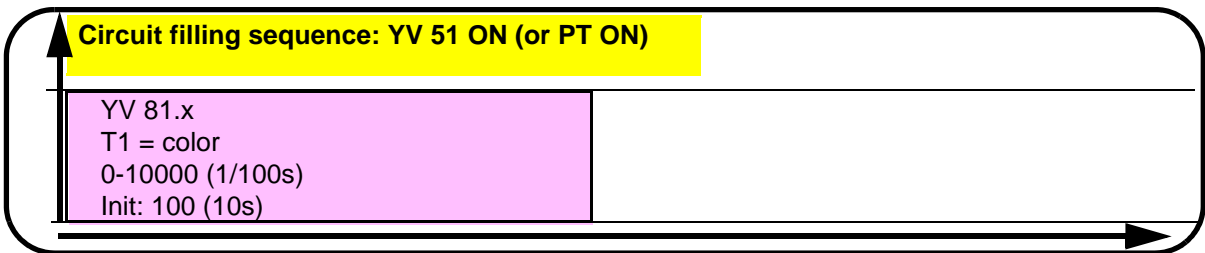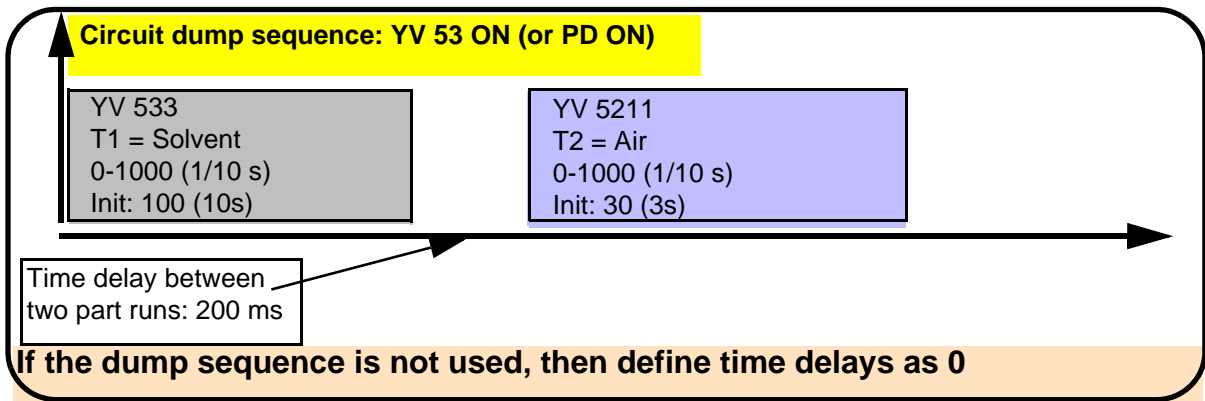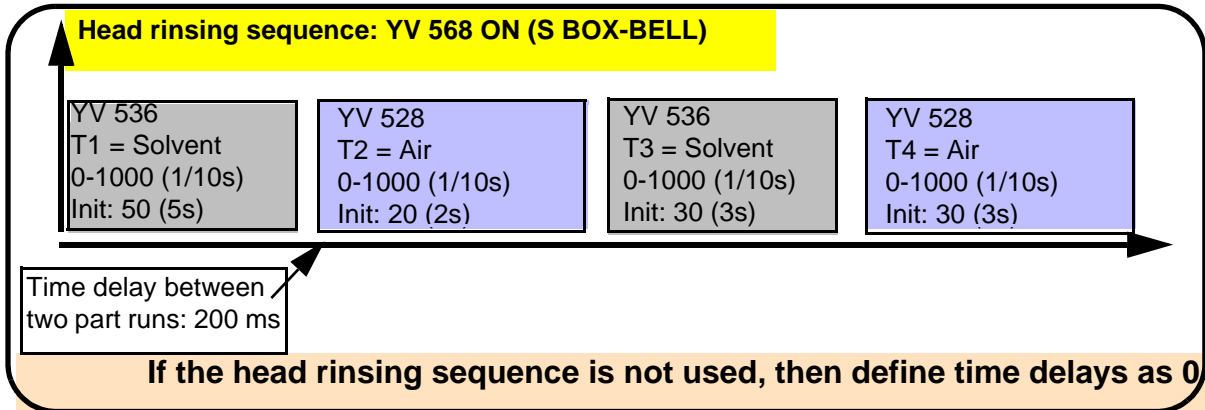| YV 533	YV 5211	YV 533	YV 5211
T1 = Solvent	T2 = Air	T3 = Solvent	T4 = Air
0-1000 (1/10s)	0-1000 (1/10s)	0-1000 (1/10s)	0-1000 (1/10s)
Init: 30 (3s)	Init: 30 (3s)	Init: 50 (5s)	Init: 30 (3s)

Time delay between two part runs: 200 ms

Head rinsing sequence: YV 568 ON (S BOX-BELL)

YV 536	YV 528	YV 536	YV 528
T1 = Solvent	T2 = Air	T3 = Solvent	T4 = Air
0-1000 (1/10s)	0-1000 (1/10s)	0-1000 (1/10s)	0-1000 (1/10s)
Init: 50 (5s)	Init: 20 (2s)	Init: 30 (3s)	Init: 30 (3s)

Time delay between two part runs: 200 ms

If the head rinsing sequence is not used, then define time delays as 0

Circuit dump sequence: YV 53 ON (or PD ON)

YV 533	YV 5211
T1 = Solvent	T2 = Air
0-1000 (1/10 s)	0-1000 (1/10 s)
Init: 100 (10s)	Init: 30 (3s)

Time delay between two part runs: 200 ms

If the dump sequence is not used, then define time delays as 0

Circuit filling sequence: YV 51 ON (or PT ON)

YV 81.x
T1 = color
0-10000 (1/100s)
Init: 100 (10s)

If the two circuits have different lengths of sequences, one sequence is considered to be complete when the longest sequence has been finished.

6.6.4. Manual mode screen

To color forcing screen	Manual mode validation	The mode changes from Stop to Manual

Start head rinsing sequence

Start circuit rinsing sequence

Start circuit filling sequence

Start circuit dump sequence

Circuit validation to the manual mode

Status indicator for air and solvent valves during sequences for each circuit

Color pilot indicator

Select colors (1 to 6)

|	
1	Activated: Head rinsing request from SBOX
2	Activated: Head rinsing underway
3	Activated: Circuit rinsing request from SBOX
4	Activated: Circuit rinsing underway
5	Activated: Circuit rinsing request from SBOX (see Note)
6	Activated: Circuit filling underway
7	Activated: Circuit dump request from SBOX
8	Activated: Circuit dump underway

Any sequence can be executed in **MANUAL** mode.
The circuits in question must be confirmed (circuit 1 or 2 ON/OFF).
This sequence request must be made from the master SBOX to the SLR module, and then if conditions are satisfied, the SLR module will transmit the request to the PFS, and the associated indicator will come on. The operator can start the associated sequence from the PFS module screen, and the mode selector indicator on the SLR module will come on.

Note: With circuit filling, it is necessary to select the desired color prior to filling and request circuit rinsing using the S-BOX module and later start the circuit filling sequence using the PFS module (the SLR module opens the valve YV51 (or PT) of the requested circuits).

To return to Stop mode, the manual mode must be deactivated by the manual confirmation button.
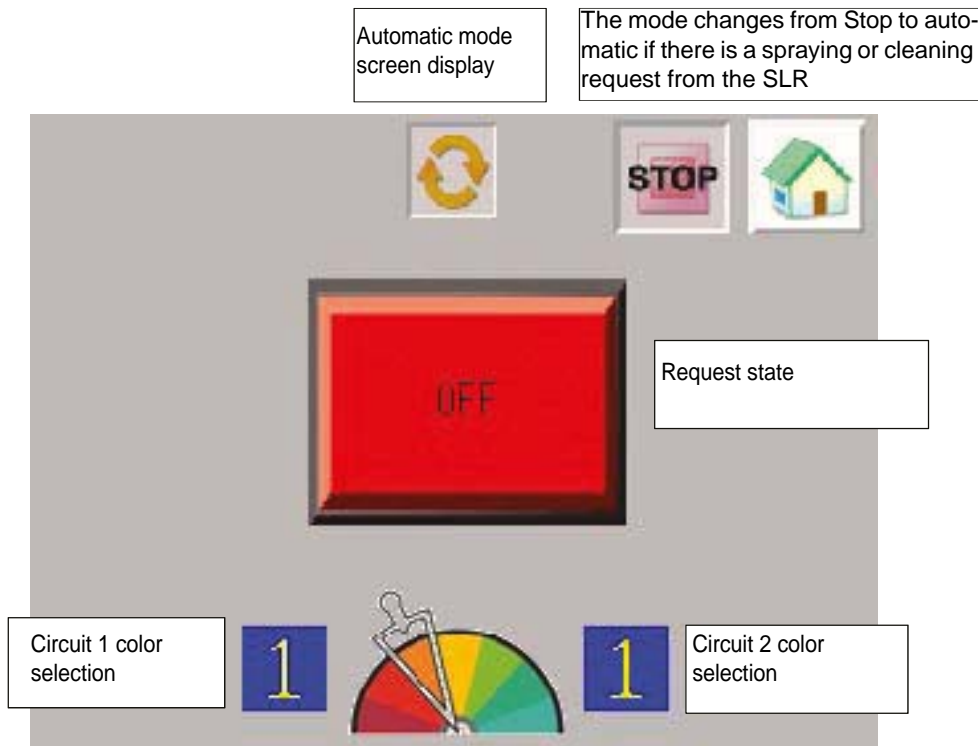
6.6.5. Forcing screen
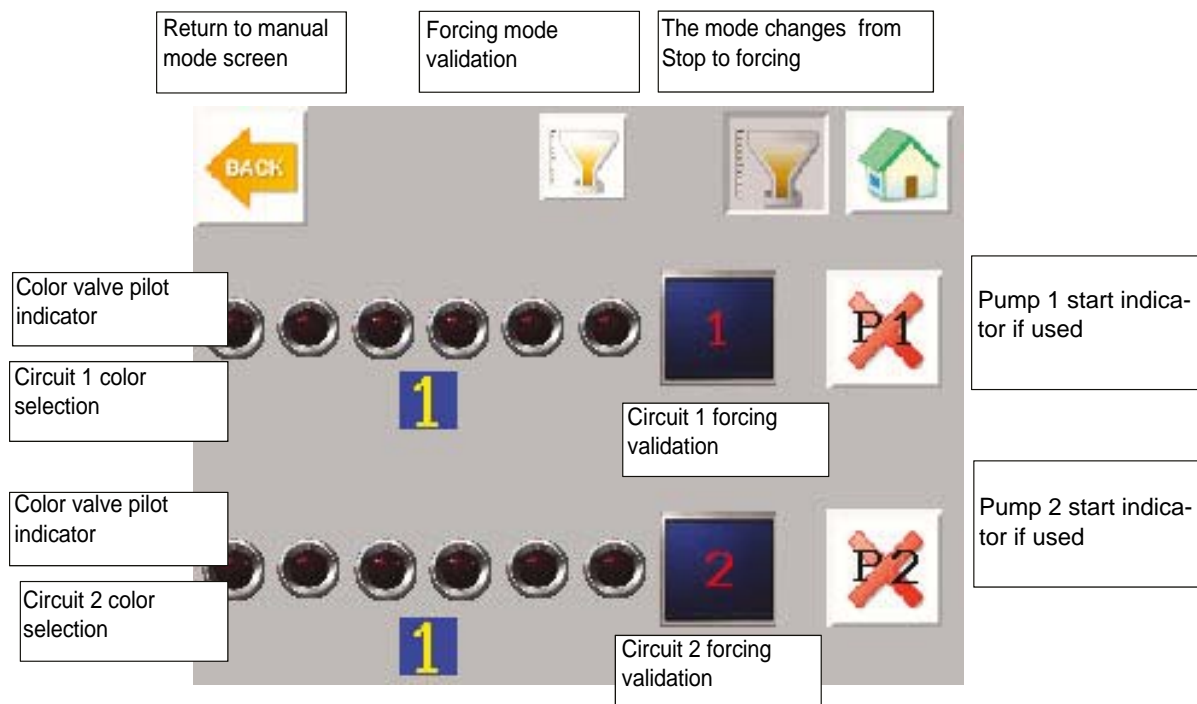
This mode is mainly used to **calibrate paint flow** for the system.
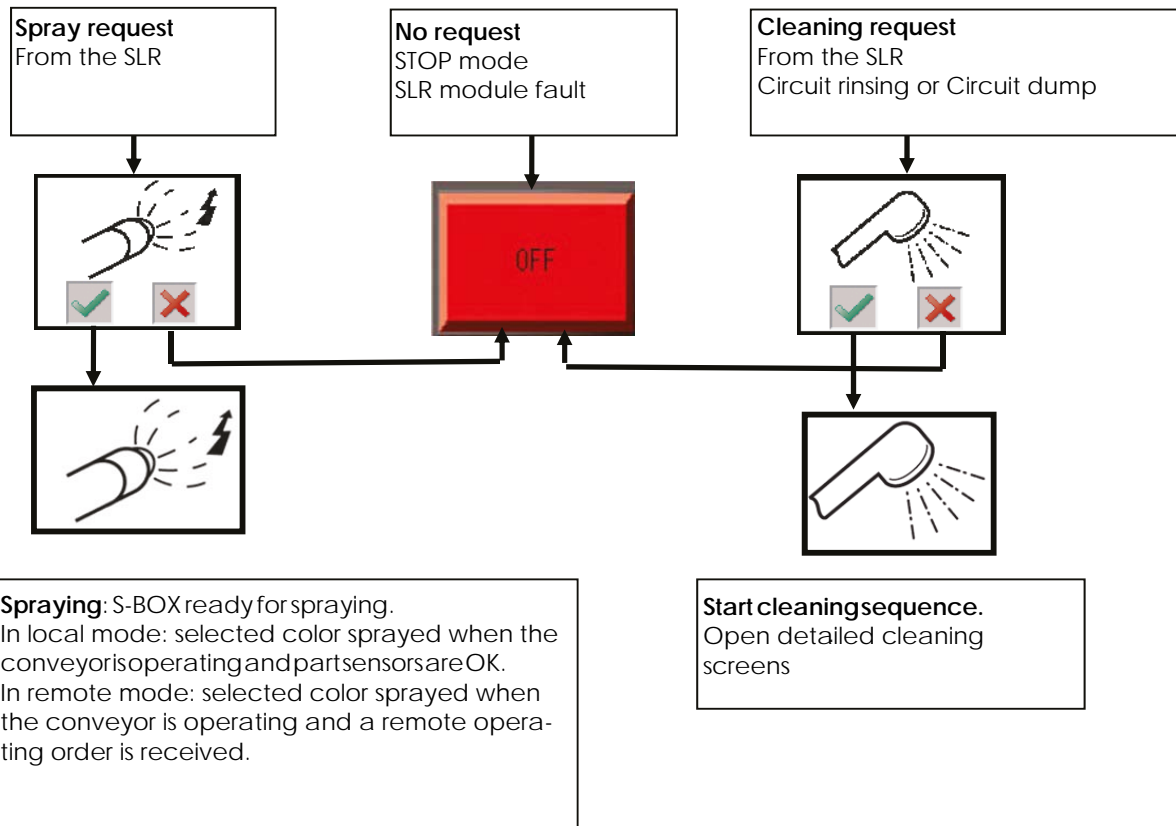This mode does not interact with the SLR module.

Circuit configuration:
- **No gear pump**: when the forcing mode is confirmed, the selected color valve is activated, and deactivated at the forcing stop request.
- **Gear pump**: forcing will only become activated when the pumps start operating.

To switch back to Stop mode, manual mode must be deactivated using the forcing validation button.
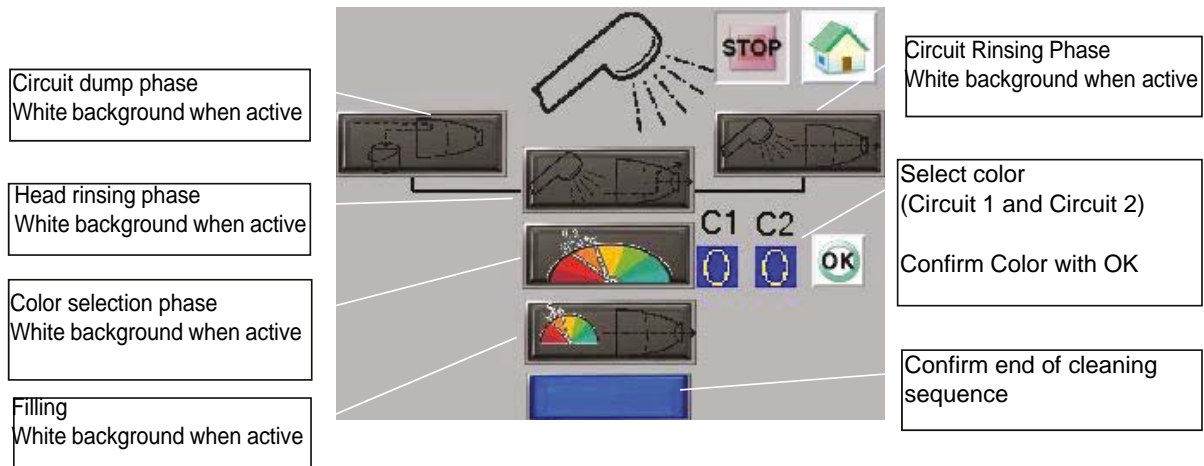
6.6.6. Mode Automatic screen

Automatic mode screen display

The mode changes from Stop to automatic if there is a spraying or cleaning request from the SLR

Request state

Circuit 1 color selection

Circuit 2 color selection

Depending on the requests from the SLR module, the request state can display the following.

Spray request
From the SLR

No request
STOP mode
SLR module fault

Cleaning request
From the SLR
Circuit rinsing or Circuit dump

Spraying: S-BOX ready for spraying.
In local mode: selected color sprayed when the conveyor is operating and part sensors are OK.
In remote mode: selected color sprayed when the conveyor is operating and a remote operating order is received.

Start cleaning sequence.
Open detailed cleaning screens

Cleaning request:

Circuit dump phase
White background when active

Head rinsing phase
White background when active

Color selection phase
White background when active

Filling
White background when active

Circuit Rinsing Phase
White background when active

Select color
(Circuit 1 and Circuit 2)

Confirm Color with OK

Confirm end of cleaning
sequence

When a phase is confirmed, the corresponding actions are activated. (Circuit dump / Head rinsing / Circuit rinsing / Circuit filling) (see § 6.6.3 page 52).

The Rinsing sequence will start after a Circuit rinsing or Circuit dump request from the SLR module (according to the request issued by the master SBOX).

- This window will open at the end of the Circuit rinsing phase if the head rinsing mode is validated (Configuration see § 6.6.2 page 51.
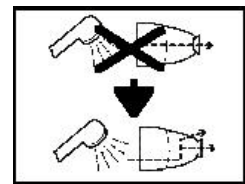
A **Head rinsing** request must then be entered using the master SBOX-BELL module.

- This window will open at the end of the **Circuit dump** phase if the head rinsing mode is validated (Configuration see § 6.6.2 page 51.
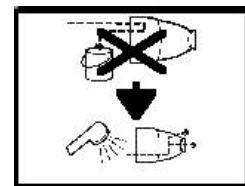
A **Head rinsing** request must then be entered using the master SBOX-BELL module.

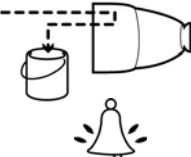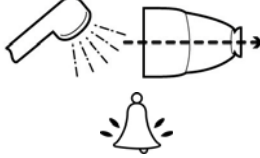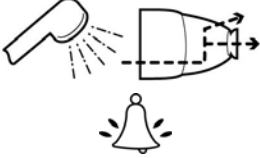The **Head rinsing** phase is then activated, if it it requested.
At the end of this phase, the **Color selection** phase starts immediately: a color must then be selected and confirmed.

The next phase, **Circuit filling** will then be active if the **Circuit rinsing** mode is selected on the master SBOX.
At the end of **Circuit filling**, the cleaning sequence is completed and the PFS module will return to STOP mode.

If a mode selected using the master SBOX does not match the current phase at any time during the execution of cleaning phases, a warning message will appear on the PFS screen, indicating which mode the master SBOX is expecting.
In addition, to stop a cleaning sequence, select the STOP mode on the master SBOX.
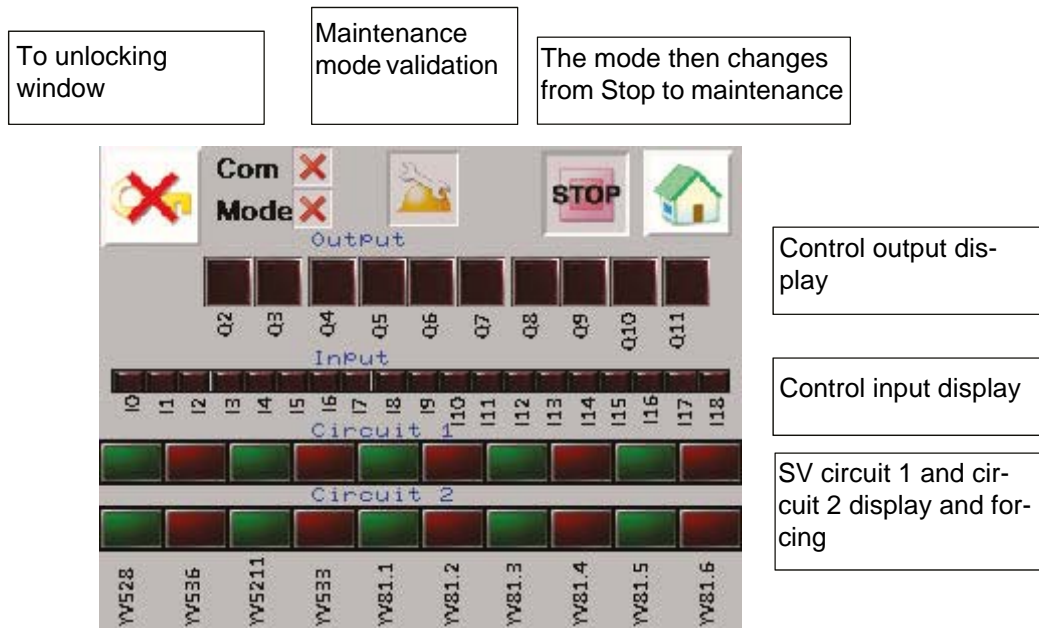
	A **Circuit dump** phase was underway and the **Circuit dump** mode is no longer selected on the SBOX. The dump phase is then stopped. The **Circuit dump** mode must be once again selected and the phase will be re-activated (starting from the beginning)
	A **Circuit rinsing** phase was underway and the **Circuit rinsing** mode is no longer selected on the SBOX. The rinsing phase is then stopped. The **Circuit rinsing** mode must be once again selected and the phase will be re-activated (starting from the beginning)
	A **Head rinsing** phase was underway and the **Head rinsing** mode is no longer selected on the SBOX. The head rinsing phase is then stopped. The **Head rinsing** mode must be once again selected and the phase will be re-activated (starting from the beginning)
	A **Circuit filling** phase was underway and the **Circuit filling** mode is no longer selected on the SBOX. The circuit filling phase is then stopped. The **Circuit rinsing** mode must be once again selected and the phase will be re-activated (starting from the beginning)

If gear pumps are used, PFS module sequences will remain unchanged.
Valves for circuit rinsing, circuit dump and circuit filling will only be controlled if the pumps are operating.

If a pump return is missing when it was expected for one of the circuits, the cleaning sequence will be blocked awaiting this return.

6.6.7. Maintenance mode screen

To unlocking window

Maintenance mode validation

The mode then changes from Stop to maintenance

Control output display

Control input display

SV circuit 1 and circuit 2 display and forcing

The state of each output and input are displayed in this view.

PLC input	Description
I10	Spraying mode
I11	Head rinsing mode
I12	Circuit rinsing mode
I13	Dump mode
I14	Pump 1 operating
I15	Pump 2 operating

PLC output	Description
Q2	KADEF fault (at 0)
Q3	PFS mode authorisation (KAOK)

The circuit 1 and circuit 2 SV may also be forced.

To do so, forcing mode must first be validated (BP on the view, with locking condition), then simply press the output you want to force to activate it. Once the output is forced the light comes on.

To switch back to Stop mode, manual mode must be deactivated using the maintenance validation button.

7. Operating principle for the REV 800 module

For the REV 800 control module see RT Nr 6435 and see RT Nr 6436.

The REV 800 is used to manage 2 "up and down" robots and pilot the spraying and high voltage trigger.
Configuration (minimum):
- Number of robots
- Calibrating heights
- Part detection
- Type of spray
- Number of sprayers by plan (minimum 2 to pilot the trigger and the high voltage trigger of a sprayer)
- Conveyor speed
- Type of data transmitted (normally open or normally closed)
- Different spray tables (zone, speed, and spraying height).

Operating mode:
The REV 800 must normally operate in automatic mode. The REV 800 module is used directly to start operations. Spraying phases will stop in the event of a module fault.

When in local mode for the SLR, the detection parameters (time delays) of the SLR will be taken into consideration.
When in remote mode for the SLR, external orders (spraying and high voltage trigger) will be received from the REV 800 as well as part detection parameters.