

Nilfisk Liberty SC50

Instructions for use

Instructions for Use
Original Instructions
Instrucciones de uso
Mode d'emploi

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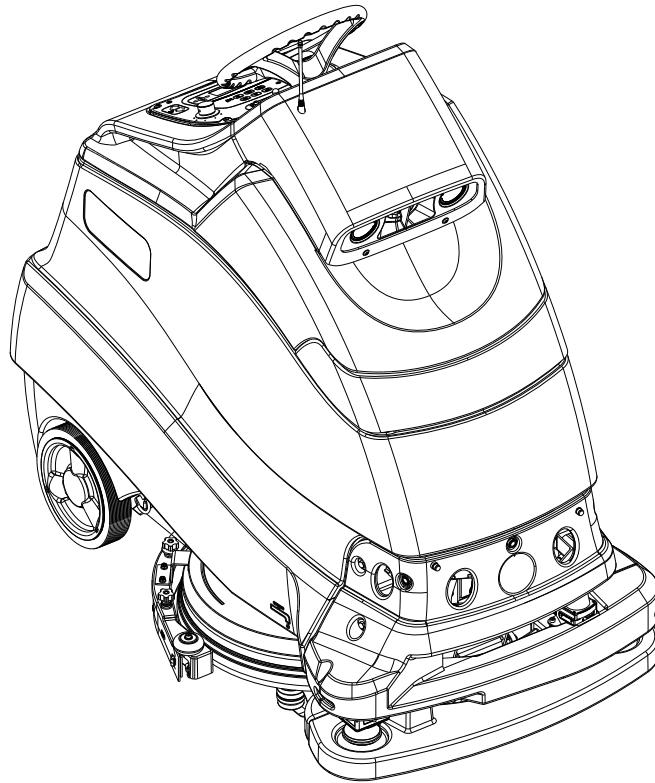
ecoflex™

A-English
B-Español
C-Français

DRAFT

REVISED

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Model No:
56104500 (X20D), 56104501 (X20R)



WARNING:

The operation of this machine is strictly reserved to trained and qualified operators.

 **Nilfisk**

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INTRODUCTION

This manual will help you get the most from your Nilfisk Scrubber. Read it thoroughly before operating the machine.

Note: Bold numbers in parentheses indicate an item illustrated on pages A-8 – A-12.

This machine is only suitable for commercial use, for example in hotels, schools, hospitals, factories, shops, offices and rental businesses. The Nilfisk Liberty SC50 is a battery powered floor cleaning machine.

WARNING:

The operation of this machine is strictly reserved to trained and qualified operators.

PARTS AND SERVICE

Repairs, when required, should be performed by Nilfisk, Inc., who employs factory trained service personnel, and maintains an inventory of Nilfisk original replacement parts and accessories.

Call NILFISK, INC. for repair parts or service. Please specify the Model and Serial Number when discussing your machine.

MODIFICATIONS

Modifications and additions to the cleaning machine which affect capacity and safe operation shall not be performed by the customer or user without prior written approval from Nilfisk, Inc. Unapproved modifications will void the machine warranty and make the customer liable for any resulting accidents.

NAME PLATE

The Model Number and Serial Number of your machine are shown on the Nameplate, located on the inside of the battery compartment.

Date of Manufacture "Date Code" is marked on the nameplate. Date Code: A17, means January 2017.

This information is needed when ordering repair parts for the machine. Use the space below to note the Model Number and Serial Number of your machine for future reference.

MODEL NO. _____

SERIAL NO. _____

UNCRATE THE MACHINE

When the machine is delivered, carefully inspect the shipping packaging and the machine for damage. If damage is evident, save the shipping carton (if applicable) so that it can be inspected. Contact the Nilfisk Customer Service Department immediately to file a freight damage claim. Refer to the unpacking instruction sheet included with the machine to remove the machine from the pallet.

TRANSPORTING THE MACHINE

CAUTION!

Before transporting the machine on an open truck or trailer, make sure that . . .

- All tanks are empty.
- Recovery tank cover is latched securely.
- The machine is tied down securely - see Tie Down Locations (6) in *Know Your Machine*. Only use locations designated as "Tie Down Locations" to secure the machine during transport. Using any other location of the machine to tie down the machine may cause damage or injury.
- The machine's electromagnetic brake is engaged (not manually overridden), see *Electromagnetic Brake* section if necessary.

CAUTIONS AND WARNINGS

SYMBOLS

Nilfisk uses the symbols below to signal potentially dangerous conditions. Always read this information carefully and take the necessary steps to protect personnel and property.

DANGER!

Is used to warn of immediate hazards that will cause severe personal injury or death.

WARNING!

Is used to call attention to a situation that could cause severe personal injury.

CAUTION!

Is used to call attention to a situation that could cause minor personal injury or damage to the machine or other property.



Read all instructions before using.

GENERAL SAFETY INSTRUCTIONS

Specific Cautions and Warnings are included to warn you of potential danger of machine damage or bodily harm.

This machine is for commercial use, for example in hotels, schools, hospitals, factories, shops and offices other than normal residential housekeeping purposes.

WARNING!

- This machine shall be used only by properly trained and authorized persons.
- The operation of this machine is strictly reserved to trained and qualified operators.
- This machine is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge.
- While on ramps or inclines, avoid sudden stops. Avoid abrupt sharp turns. Use low speed down ramps.
- Observe the Gross Vehicle Weight, GVW, of the machine when loading, driving, lifting or supporting the machine.
- Keep sparks, flame and smoking materials away from batteries. Explosive gases are vented during normal operation.
- Charging the batteries produces highly explosive hydrogen gas. Charge batteries only in well-ventilated areas, away from open flame. Do not smoke while charging the batteries.
- Remove all jewelry when working near electrical components.
- Turn the machine power OFF and disconnect the batteries before servicing electrical components.
- Never work under a machine without safety blocks or stands to support the machine.
- Do not dispense flammable cleaning agents, operate the machine on or near these agents, or operate in areas where flammable liquids exist.
- Do not clean this machine with a pressure washer.
- Only use the brushes or pad driver provided with the appliance or those specified in the instruction manual. The use of other brushes may impair safety.
- Do not look at the laser beams used by the machine. Permanent eye damage could result. Lasers are eye-safe if viewed briefly, such as to determine that they are functioning. Do not look directly into lasers or stare at them without wearing protective laser safety glasses.
- Safety Lasers work to detect the presence of individuals in the area of an operating machine. Safety Lasers function only in the Autonomous Operating Mode.

CAUTIONS AND WARNINGS - CONTINUED** CAUTION!**

- This machine is not approved for use on public paths or roads.
- This machine is not suitable for picking up hazardous dust.
- Do not use scarifier discs and grinding stones. Use only pads or brushes intended for floor cleaning. Nilfisk will not be held responsible for any damage to floor surfaces caused by using the wrong or improper pads or brushes.
- When operating this machine, ensure that third parties, particularly children, are not endangered.
- Before performing any service function, carefully read all instructions pertaining to that service task.
- After use do not leave the machine unattended where it can be accessed by others without first powering the machine off at the power switch.
- Power the machine OFF at the power switch and remove the magnetic SmartKey, before changing the brushes, and before opening any access panels.
- Take precautions to prevent hair, jewelry, or loose clothing from becoming caught in moving parts.
- Use caution when moving this machine in below freezing temperature conditions. Any water in the solution, recovery or detergent tanks or in the hose lines could freeze, causing damage to valves, pumps and fittings. Flush with low-temperature windshield washer fluid.
- The batteries must be removed from the machine before the machine is scrapped. The disposal of the batteries should be safely done in accordance with your local environmental regulations.
- Do not use on surfaces having a gradient exceeding that marked on the machine.
- All doors and covers are to be positioned as indicated in the instruction manual before using the machine.
- This machine should only be used and stored indoors.
- The machine's magnetic SmartKey has a built-in magnet. Do not place objects having magnetic bands (such as credit cards, electronic keys, phone cards) near the key. The built-in magnet can damage or erase the data stored on the magnetic bands.
- Only use locations designated as "Tie Down Locations" to secure the machine during transport. Using any other location of the machine to tie down the machine may cause damage or injury.

CAUTIONS AND WARNINGS - CONTINUED

CAUTION!

- Do not operate the machine in an environment exceeding 104°F (40°C).
- Do not operate the machine without the Bumper **(18)** in place.
- Avoid driving the machine onto stairways or escalators, into open elevator shafts, or into any area where there is a significant drop in elevation. Serious machine damage may result if it falls down stairs, escalators, or open shafts. The machine cannot climb stairs. Machine is designed for use only on flat surfaces (less than 2 degree incline). Place safety cone in front of escalators to prevent machine entry.
- While driving the machine manually, to develop navigational maps as part of training the autonomous function, it is the Operator's responsibility to avoid contact with obstacles. The machine will not avoid them in the manual operating mode. There are no autonomous safety functions operating in the manual mode.

CAUTIONS FOR 2-D MAPPING LASER (14)

CLASS 1 LASER PRODUCT

The 2-D Laser Scanner corresponds to laser class 1 (eye-safe).

The laser beam is not visible to the human eye.

CAUTION!

- The use of controls, or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Do not open the housing (opening the housing will not switch off the laser).
- Pay attention to the laser safety regulations as per IEC 60825-1 (latest version).

CAUTIONS AND WARNINGS - CONTINUED** CAUTION!****CAUTIONS FOR 2-D SAFETY LASER (17)**

Read the following guidelines for correct use of the 2-D Safety Laser (17) hence referred to as the UAM. Proper handling and usage will ensure the UAM to operate accordingly.

GENERAL PRECAUTIONS

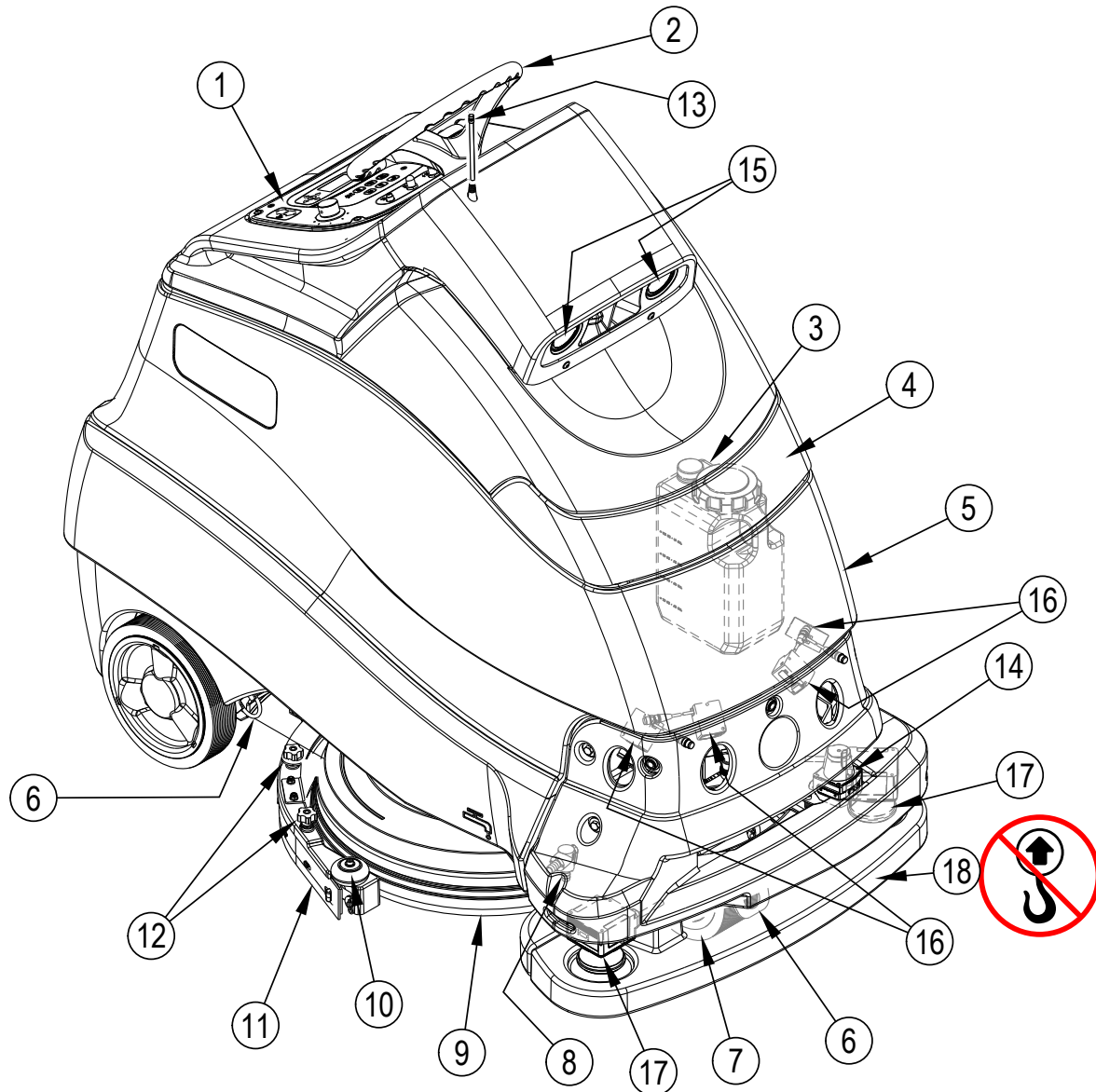
- UAM is designed to protect human beings or systems by monitoring the hazardous area. It is not designed for the protection from high speed objects or the electromagnetic radiation.
- Perform pre operation tests in order to verify the performance of UAM.
- Do not modify or disassemble UAM. Such modifications will affect the detection capability leading to injuries or death.
- Do not modify or disassemble UAM to maintain its housing rating. Such modifications will void the warranty.
- The person in charge should be qualified to operate UAM. The person must be trained, on safety requirements with necessary cautions for handling the device.
- The person in charge should train the user with correct installation, operation, inspection and maintenance procedures.
- The person in charge is responsible to ensure the proper working environment for UAM.
- The person in charge is responsible for the compliance with the local safety requirements, standards, rules and regulations, laws of respective nations, states or districts when UAM is used in a safety related system.
- UAM has been manufactured and shipped under the strict quality control. If you find any defect in the product contact the nearest distributor or sales representative.
- Hokuyo cannot be held responsible for the damages or failure due to misuse of the product.
- User should prepare test pieces for detection capability verification. The test piece should emulate the smallest object that is intended to be detected during the operation.
- Maximum level of homogeneous pollution for UAM to operate normally is under 30%. UAM will report error if the pollution exceeds the stated limit. Always keep the optical window in clean condition to avoid the error.
- Before resetting the interlock of UAM, user must ensure the surrounding is safe especially the protected area.
- Apply sufficient measures to ensure safety of the protected area when decommissioning UAM. Protective materials such as guards or light curtain should be used to prevent the passage to the hazardous area.
- UAM including its accessories are subject to change without prior notice for the improvement.
- UAM should be disposed as industrial waste or in accordance with the local disposal directives.

SAVE THESE INSTRUCTIONS

KNOW YOUR MACHINE

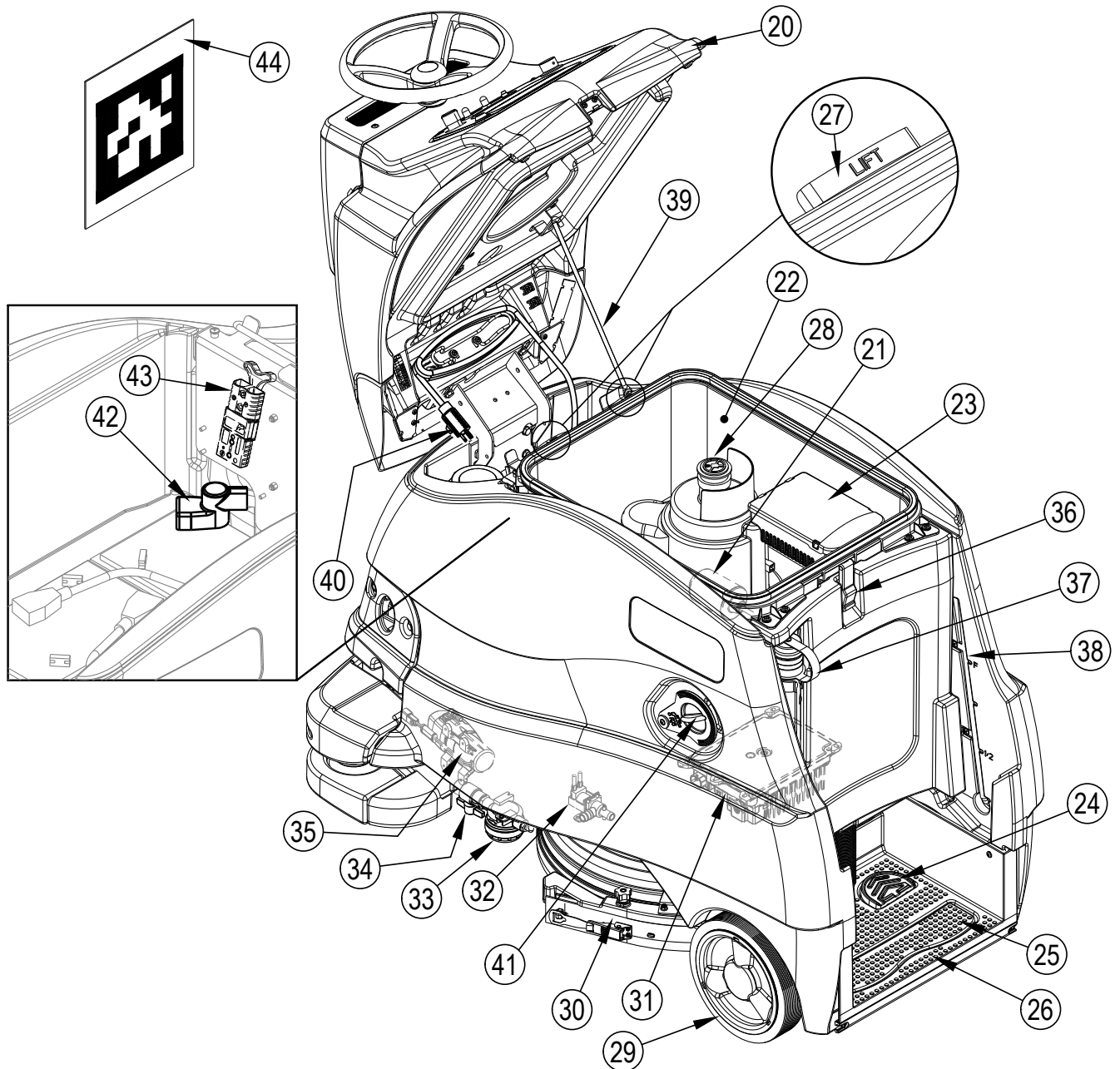
As you read this manual, you will occasionally run across a bold number or letter in parentheses - example: **(2)**. These numbers refer to an item shown on these pages unless otherwise noted. Refer back to these pages whenever necessary to pinpoint the location of an item mentioned in the text. **NOTE:** Refer to the service manual for detailed explanations of each item illustrated on the next 4 pages.

- | | | | |
|----------|-------------------------------|-----------|---|
| 1 | Control Panel | 10 | Squeegee Roller |
| 2 | Steering Wheel | 11 | Squeegee Assembly |
| 3 | Detergent Cartridge | 12 | Squeegee Cover Knobs (4) |
| 4 | LED Status Bar | 13 | Antenna |
| 5 | Solution Tank | 14 | 2-D Mapping Laser |
| 6 | Tie Down Locations (3) | 15 | 3-D Camera Lenses |
| 7 | Drive Wheel | 16 | Drop-Off Safety Laser (4) |
| 8 | Solution Drain Valve | 17 | 2-D Safety Laser (2) |
| 9 | Scrub Deck | 18 | Bumper (NOT a lifting or tie down point) |



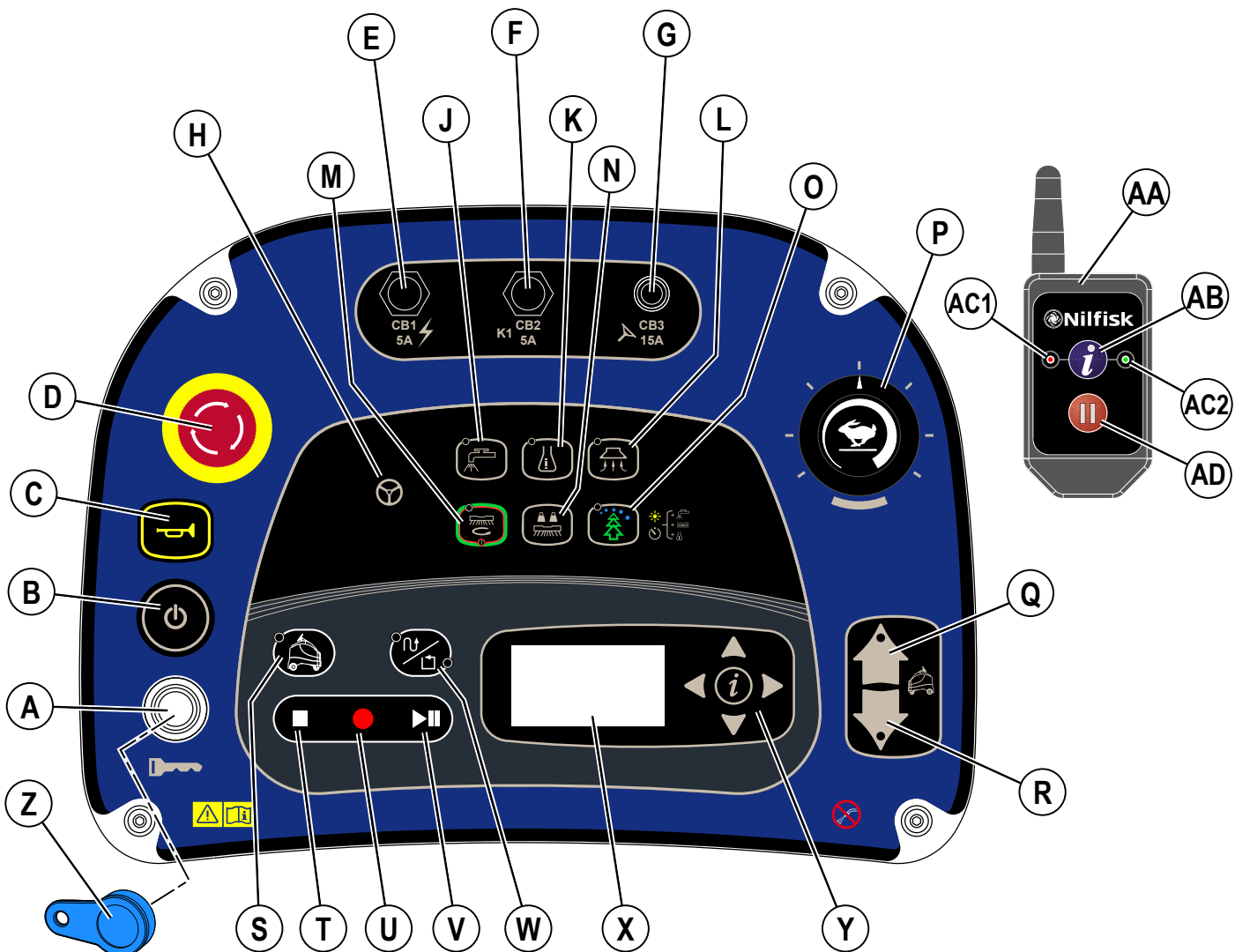
KNOW YOUR MACHINE

- 20 Control Panel Housing / Recovery Tank Cover
- 21 Recovery Tank Full Float
- 22 Recovery Tank
- 23 Debris Catch Tray
- 24 Go Pedal
- 25 Operator Presence Pedal
- 26 Platform
- 27 Recovery Tank Lift Handles (2)
- 28 Vacuum Motor Fan Inlet Screen
- 29 Rear Wheel (2)
- 30 Rear Squeegee Blade Removal Latch
- 31 Battery Charger
- 32 Solution Solenoid Valve
- 33 Solution Filter
- 34 Solution Shutoff Valve
- 35 Solution Pump
- 36 Latch
- 37 Recovery Tank Drain Hose
- 38 Solution Tank Level Sight Tube
- 39 Prop Rod
- 40 On-Board Charger Power Cord
- 41 Solution Tank Fill Port
- 42 Fuse Holder Boot (Main Fuse 100 Amp)
- 43 Machine Battery Connector
- 44 Location Tag



CONTROL PANEL

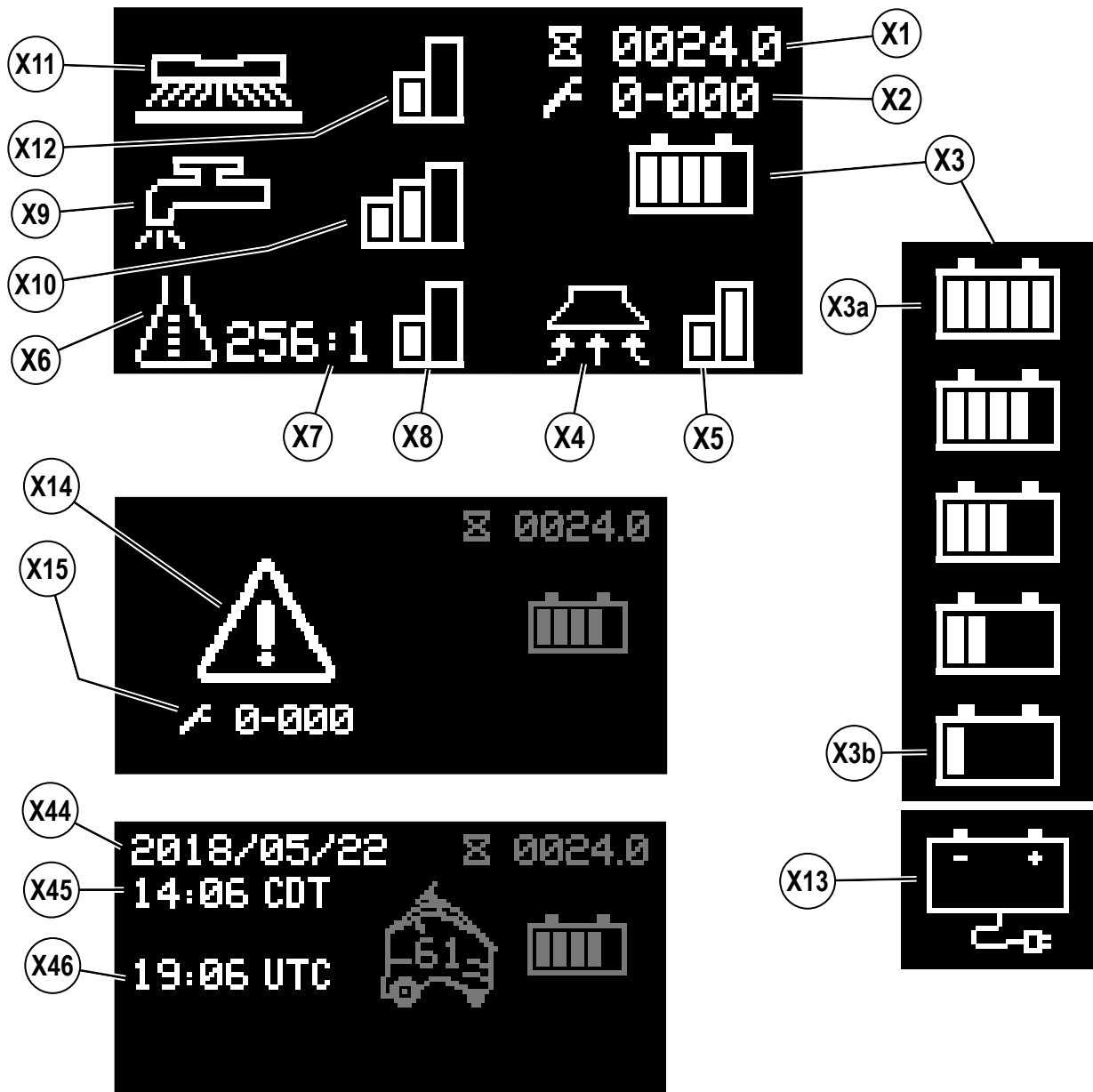
- A SmartKey™ Reader
- B Power Switch
- C Horn Switch
- D Emergency Stop
- E Control Circuit Breaker (5 Amp)
- F Circuit Breaker (K1) (5 Amp)
- G Steering Motor Circuit Breaker (15 Amp)
- H Manual Operation Indicator
- J Solution Flow Adjustment Switch
- K Detergent Switch
- L Vacuum Switch
- M One-Touch™ Scrub ON/OFF Switch
- N Extra Pressure Switch
- O Burst of Power Switch
- P Speed Adjustment Knob
- Q Forward Drive Switch
- R Reverse Drive Switch
- S Autonomous Mode / Autonomous Menu Switch
- T Stop Switch
- U Record Switch
- V Play/Pause Switch
- W CopyCat™/Fill-In Switch
- X Display (see Control Panel-Continued)
- Y Information Switch & Navigation Switches
- Z Magnetic SmartKey™
-Blue = User
-Yellow = Supervisor
- AA Remote
- AB Remote Status Request Button
Remote Status Indicators
AC1 - Red LED = Machine Alarm State
AC2 - Green LED = Machine Functioning Normally
- AD Remote Pause Button



CONTROL PANEL - CONTINUED

- X1 Hour Meter (Drive Hours) [see page 13]
- X2 Active Fault Codes [see page 48]
- X3 Battery Charge Indicator [see page 43]
 - X3a = Battery Charge Full
 - X3b = Battery Charge Low
- X4 Vacuum Indicator
- X5 Vacuum Indicator Bar Graph
 - FIRST = Quiet Mode
 - SECOND = Regular Mode
 - NONE = Off
- X6 Detergent Indicator
- X7 Detergent Ratio/Percentage Indicator
- X8 Detergent Indicator Bar Graph
 - FIRST = Detergent Low Mode
 - SECOND = Detergent High Mode
 - NONE = Off

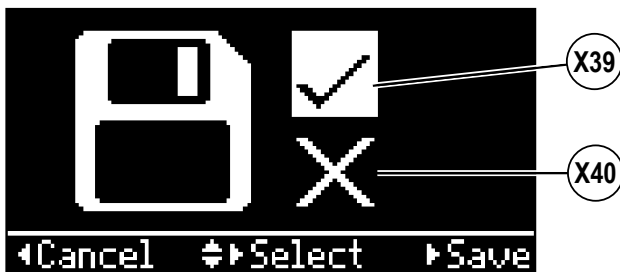
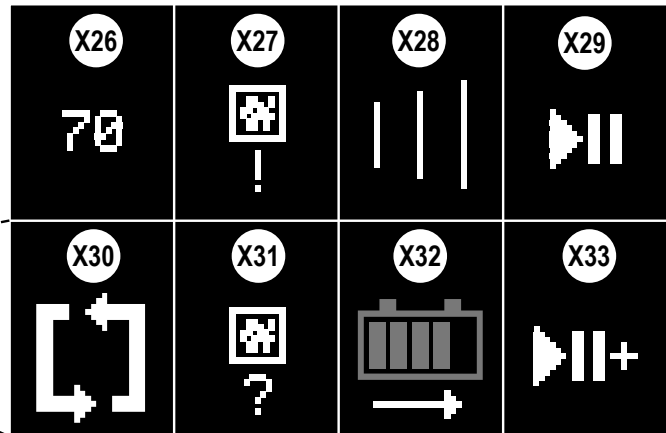
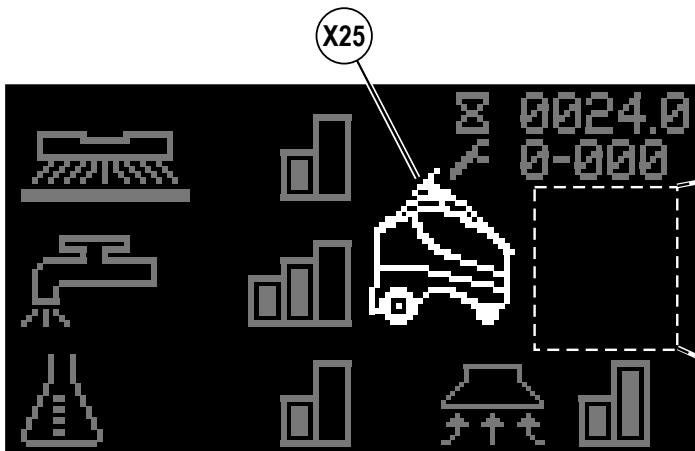
- X9 Solution Flow Indicator
- X10 Solution Flow Rate Bar Graph
 - FIRST = Low
 - SECOND = Medium
 - THIRD = High
 - NONE = Off
- X11 Scrub Pressure Indicator
- X12 Scrub Brush Pressure Bar Graph
 - FIRST = Regular
 - SECOND = Heavy
 - NONE = Off
- X13 Battery Low Voltage Indicator
- X14 Critical Fault Indicator
- X15 Fault Code (Critical)
- X44 Date Display (Year/Month/Day)
- X45 Time Display (Local)
- X46 Time Display (Coordinated Universal Time)



CONTROL PANEL - CONTINUED

- X16 Recovery Tank Full Indicator
- X17 Purge Indicator
- X18 Emergency Stop Activated Indicator
- X19 No Key Indicator
- X20 Key Read Error Indicator [see Troubleshooting]
- X21 Restricted User Key Indicator [see Troubleshooting]
- X22 Burst of Power Indicator
- X23 Solution Tank Empty Indicator
- X24 Impact Lockout Indicator
- X25 Autonomous Indicator
- X26 Countdown Timer
- X27 Go To Home Position Indicator
- X28 Advancing Lines (machine in Training or Playback)

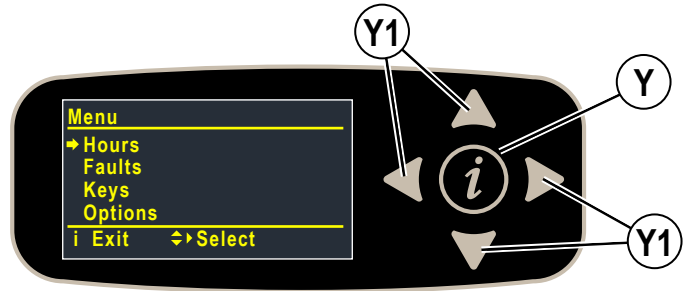
- X29 Playback Available Indicator
- X30 Spinning Arrows / Computer Processing
- X31 No Home Position Set Indicator
- X32 Machine On A Plan Indicator
- X33 Resume Plan Available Indicator
- X38 Remove Key Indicator
- X39 Save Plan Indicator
- X40 Delete Plan Indicator



INFORMATION MENU DISPLAY

Menu Display

Pressing the Information Switch (Y) will bring up the menu shown below which allows the operator to change machine settings and gather machine information. Use the four Navigation Arrows (Y1) (up, down, left & right) to move through the menu and the information switch to exit the menu.



Menu visible with either blue (User) or yellow (Supervisor) SmartKey.

Menu Level		Notes
1	2	
Hours		Displays various system hours
	On Time	Displays Power ON hours
	Drive Time	Displays drive (non-neutral) hours
	Scrub Time	Displays scrub/brush ON hours
	CopyCat Teach	Displays hours spent training CopyCat plans
	Fill-In Teach	Displays hours spent training Fill-In plans
	CopyCat Replay	Displays hours spent playing back CopyCat plans
	Fill-In Replay	Displays hours spent playing back Fill-In plans
	Recovery Time	Displays recovery/vacuum ON hours
Faults**		
	Active Faults	Displays list of active faults w/ timestamp and description
	Fault History	Displays list of fault history w/ timestamp and description
	Clear Autonomy History***	Clear autonomy fault history list

**See Fault Code Display

***Supervisor and Technician Only

Menu visible only with yellow (Supervisor) SmartKey.

Menu Level			Notes
1	2	3	
Keys			
	Read Key		Read the key serial number, family and type for key inserted into holder - if user key, allows supervisor to add to key list - if key is of appropriate type, allows supervisor and technician to program a supervisor key
	Key List		Display the current approved user key list supervisor can also remove selected key from list
	Add Key		
	Clear Key List		
Options			Supervisor selectable options
	Language	English* Italiano Deutsch Portuguese Français Español	Menu display language
	Scrub Startup	Light Heavy Last Used*	Scrub level at start
	Scrub Max	Light Heavy*	Maximum scrub level allowed

*Default setting

INFORMATION MENU DISPLAY – CONTINUED

Menu visible only with yellow (Supervisor) SmartKey.

Menu Level			Notes
1	2	3	
Options			Supervisor selectable options
	Solution	SmartFlow* (proportional to speed) Fixed	Adjust solution flow to speed, or fixed flow
	Solution In Rev	No* Yes	Leave solution on in reverse?
	Warning Beep	Backup Beep* Beep On Beep Off	Beep when backing up, beep always on when moving, beep off
	Autonomy Beep	Beep Off* Beep Low Beep Medium Beep High	Beep when scrubbing autonomously – off, low, medium, high volume
	Other Sounds	Normal Quiet Off	Volume of sounds (apart from horn, starting autonomy beep, and backup beep)
	Manual Light	On to Scan* Always On Always Off	“On to Scan” means the LED strip will be white with blue corners when the camera is attempting to read a Location Tag or a QR Code.
	Obstacle Color	Red Orange	Color of “Obstacle” chasing lights displayed on LED status bar when an obstacle is encountered
	Detergent Low	(300,256,200,150,128,100,64,50,32,26):1 – ratio cannot be > Detergent High (0.3, 0.4, 0.5, 0.7, 0.8, 1.0, 1.5, 2.0, 3.0, 3.8)% – percentage cannot be > Detergent High	Set detergent ratio for detergent low level
	Detergent High	(300,256,200,150,128,100,64,50,32,26):1 – ratio cannot be < Detergent Low (0.3, 0.4, 0.5, 0.7, 0.8, 1.0, 1.5, 2.0, 3.0, 3.8)% – percentage cannot be < Detergent Low	Set detergent ratio for detergent high level
	Detergent shown as	xxx:1 x.x%	Ratio or percentage
	Neutral Delay (s)	min = 0.5* max = 5.0 step = 0.5	Time to keep brushes on when in neutral (seconds)
	Vac Off Delay (s)	min = 15* max = 25 step = 1	Time to keep vacuum on after turning off scrub system (seconds)
	Vac Startup	Full Quiet Last Used*	Vacuum level at start
	Burst Of Power (s)	min = 60* max = 300 step = 60	Burst-of-power (BOP) time span (seconds)
	Fwd Speed Max (%)	min = 50% max = 100%* step = 10	Maximum forward speed as percentage of maximum available speed in manual mode
	Inactivity Time (min)	min = 5 max = 60 step = 5 default = 15	Inactivity time before putting machine in sleep mode (minutes)

*Default setting

INFORMATION MENU DISPLAY – CONTINUED

Menu visible only with yellow (Supervisor) SmartKey.

Menu Level			Notes
1	2	3	
Options			Supervisor selectable options
	User	Replay Only* Replay/Train Replay/Train/Delete No Add/Delete Tags*	User key plan permissions -- only replay; replay and train; replay, train, and delete plans
		Add Tags Add/Delete Tags	User key location tag permissions -- no permissions, can add tags, can add and delete tags
	Delete ALL PLANS?	Yes/No	Deletes all plans
	Delete ALL TAGS?	Yes/No	Delete all tags (and plans)
	Ignore water meter?	Yes/No	Ignore water meter and do constant flow with no feedback loop. Allows operator to keep cleaning in autonomous or manual mode with a broken flow meter.
	OvrCurProt. Enabled?	Yes/No	Over Current Protection can be disabled for using the machine on certain rubber flooring where current draw is higher than expected
	Impact Action	Log Only* Log & Lock	Impact detection status Log Only – Impact is recorded Log & Lock – Impact is recorded and User is locked out of scrub functions (Display shows (X24)) until machine is reset with a Supervisor key.
	Impact Level	High* Low	Impact detection sensitivity level. If nuisance tripping occurs (i.e. driving over a floor transition), adjust setting to low.
	Impact Log User ID?	Yes/No	Whether to record the User ID in the impact log
	Date/Time/Timezone		Set the date, time and timezone
		Timezone	Choose timezone that matches machine's location
		Hour	Set current time, hours in 24-hour format
		Minute	Set current time minutes
		Second	Set current time seconds
		Year	Set current year
		Month	Set current month
		Day	Set current day

*Default setting

INFORMATION MENU DISPLAY – CONTINUED

Menu visible with either blue (User) or yellow (Supervisor) SmartKey.

Menu Level		Notes
1	2	
System		
	A1 Firmware Rev	Display current firmware revision
	A8 Charger F/W	Display current charger firmware revision
	A1 Serial Number	Display PCB serial number from factory
	A5 Compute	Display current autonomy Compute box firmware
	A5 Platform	Display current autonomy Platform box firmware
	A5 Safety	Display current autonomy Safety box firmware
	E5 Camera	Display current Camera firmware
	2D Map Laser	Display current Mapping Laser firmware
	Impact Log**	Display list of impact events with max value, timestamp and user id (only if enabled) - single item view will show max values for each axis (x,y,z)
	CRL Wireless Update**	Go to menu for wireless update of autonomy firmware
	Network Status	Is network up, or down (down includes an error number)
	IP Address	IP Address of machine, shown as 123.456.789.666
	QR String	QR string scanned in from "Scan QR Code" menu command
Autonomy		
	Create Location Tag***	Creates the first locatoin tag
	Scan new locatoin tag***	Adds a new location tag
	Delete current tag #NNN***	Deletes the current tag NNN (deletes all plans)
	Delete next seen tag***	Deletes the next tag scanned
	Delete this plan***	Deletes the plan the machine is currently on
	Change Location Tag	Forget the current tag and scan for a known tag

**Only visible with yellow (Supervisor) SmartKey.

***Only visible to blue User key if permission is granted by Supervisor.

AUTONOMOUS MENU (INFORMATIONAL MESSAGES)

Pressing the Autonomous Mode / Autonomous Menu Switch (S) will bring up a menu of information and/or actions the operator can take at that particular point in time (menu will vary depending upon what the machine is currently doing, where it's located and what is allowed). Use the four Navigation Arrows (Y1) (up, down, left & right) to move through the menu and the information switch to exit the menu. The table below shows informational messages, the table on the next page shows actions that can be taken directly from the menu.



Machine State	Appears on Display	Autonomous Menu
During startup	(X25) & (X26) 	Autonomy is booting up ...[countdown timer] Manual mode available
After startup, autonomy has failed to boot up.	Active Fault Code 	Autonomy Unavailable Autonomy not responding Manual mode only
While operator is training a CopyCat plan	(X25) & (X28) 	Training a copycat Press ■ or ● to end Press ▶ to pause
While operator is training a Fill-In plan	(X25) & (X28) 	Training a fill-in Press ■ or ● to end Press ▶ to pause
While machine is playing back a CopyCat plan	(X25) & (X28) 	Playing back a copycat Press ■ to stop Press ▶ to pause
While machine is playing back a Fill-In plan	(X25) & (X28) 	Playing back a fill-in Press ■ to stop Press ▶ to pause
After training a new plan, machine needs time to compile/save the plan	(X25) & (X30) 	Autonomy compiling a plan If you move the machine, it will become lost and need to see a tag when done
At the start of a plan	(X29) 	At start: ▶ to replay
Within the resume area of a paused plan	(X33) 	Continue: ▶ to resume
Not on a trained plan	Manual Mode Display	No plan: ● make new plan
At the start of a plan but unable to play the plan	(X13) 	LOW BATTERY No Autonomy functions

AUTONOMOUS MENU (ACTIONS/COMMANDS)

Pressing the Autonomous Mode / Autonomous Menu Switch (S) will bring up a menu of information and/or actions the operator can take at that particular point in time (menu will vary depending upon what the machine is currently doing, where it's located and what is allowed). Use the four Navigation Arrows (Y1) (up, down, left & right) to move through the menu and the information switch to exit the menu. The table below shows actions that can be taken directly from the menu, the table on the previous page shows



informational messages.

Machine State	Appears on Display	Autonomous Menu
No home tag set	(X31) 	► <u>Need to set home tag!</u> Create home tag ◀Back ⬆▶Select Tag:0 . . *
Machine is disoriented	(X27) 	► <u>Lost, show me a tag!</u> Set new home tag Delete next seen tag ◀Back ⬆▶Select Tag:0 . . *
On a trained plan	(X25) & (X32) 	<u>On plan:</u> ● <u>make new plan</u> Delete this plan ◀Back ⬆▶Select
Not on a trained plan	Manual Mode Display	► <u>No plan:</u> ● <u>make new plan</u> Set new home tag Delete current tag #4** Delete next seen tag Become lost ◀Back ⬆▶Select Tag:4**

*Tag: 0 . . moving "0" indicates that machine is actively scanning for a location tag.

**Tag: "x" where "x" is the location tag ID number.

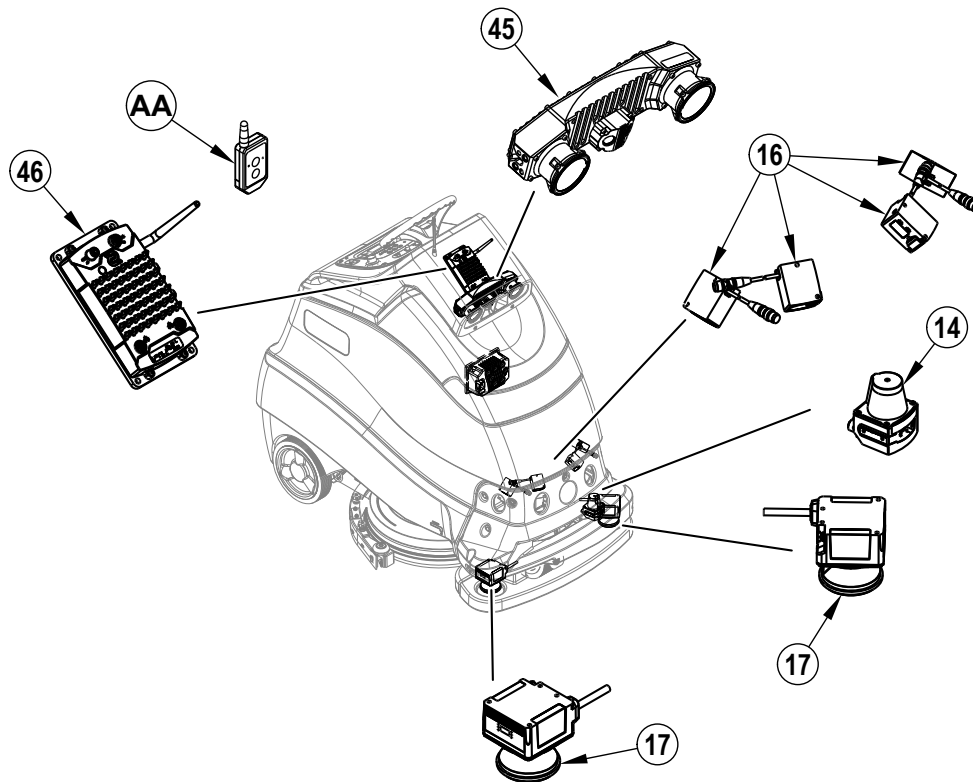
UNDERSTANDING AUTONOMY

The Nilfisk Liberty SC50 can function autonomously meaning that it functions (operates) on its own, without operator involvement. The machine can be trained to clean an area independently and actively maneuver around certain obstacles.

Components that make up the Autonomy system, and their basic function, include the following (shown in Figure 1-1):

- 3-D Camera (45) - provides a three-dimensional image of the area in front of the machine.
- 2-D Mapping Laser (14) - provides detection of obstacles in front of and to the left of the machine.
- Drop-off Safety Lasers (16) - detect drop-offs, or major changes in floor elevation.
- 2-D Safety Lasers (17), located at front corners of machine – aides in collision prevention and presence detection in the area of an operating machine.
- Remote (AA). This allows the exchange of status information between the operator and the machine.
- Autonomy Box (46). This is the primary computer for safety during operation.*
- Computer software Interface, (not shown). Defines how the autonomous control system interfaces with machine control software and control system.

FIGURE 1-1



***NOTE**

This equipment is approved for this application by the Federal Communications Commission (FCC). FCC ID: 2AMDR00068. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

***NOTE**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not in-stalled and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

REMOTE

The battery-powered Remote **(AA)** (shown in **Figure 1-2**) is a hand-held device that provides two-way communication when the machine is operating autonomously. Normally it is used when the machine is operating some distance from the operator, and they cannot see or hear it.

NOTE

Remote is approved for this application by the Federal Communications Commission (FCC). FCC ID: 2AMDR00069. This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this device, not expressly approved by the party responsible for compliance, could void the user's authority to operate the equipment.

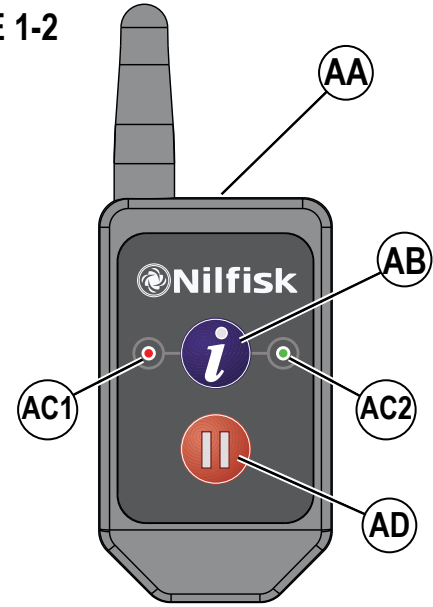
Start-up Check

1. Remote will flash both LEDs **(AC1 & AC2)** and beep, when the machine is powered ON to indicate machine and remote are properly paired together.








While the machine is operating in autonomous mode there are three interactions the operator can have with the machine through the remote.

- 1- The remote can communicate to the operator by sending alerts using the LEDs and audible beeps
- 2- User can request machine status information.
- 3- User can use the remote to pause the playback of a plan while operating autonomously.

FIGURE 1-2



Remote Status Guide

Button Pressed	Response Seen	Machine Mode
N/A	Flashes red (left LED) (AC1)  Beeps	Unexpected exit out of autonomy
	Flashes red & green (left & right LED) (AC1 & AC2)  Beeps	Plan playback is complete
 (AB)	Green flash when pressed (AC2) 	Remote is transmitting Machine is off or out of range if no response is seen within 5 seconds of press
	Solid green, 5 seconds after pressed (AC2) 	Signal received, in Autonomous
	Solid red, 5 seconds after pressed (AC1) 	Signal received, in Manual
 (AD)	Machine stops	Machine has been paused in autonomous mode - Machine playback cannot be restarted via the remote. Return to the machine with SmartKey to restart.
	Beeping stops	Machine was in alarm mode, alarms have now been turned off - Return to the machine with SmartKey and clear the error.

PREPARE THE MACHINE FOR USE

BATTERIES

If this machine shipped with batteries installed do the following:

- Check that the batteries are connected to the machine.
- Press the Power Switch (B) to power ON machine and check the Battery Indicator (F8). If the gauge is completely filled the batteries are ready for use. If the gauge is less than full the batteries should be charged before use. See the "Charging the Batteries" section.
- **IMPORTANT!: IF YOUR MACHINE HAS AN ONBOARD BATTERY CHARGER REFER TO THE OEM PRODUCT MANUAL FOR INSTRUCTIONS REGARDING SETTING THE CHARGER FOR BATTERY TYPE.**

If this machine shipped without batteries installed do the following:

- Consult an Authorized Nilfisk dealer for recommended batteries.
- Install the batteries by following the instructions below.
- **IMPORTANT!: THIS MACHINE HAS AN ONBOARD BATTERY CHARGER REFER TO THE OEM PRODUCT MANUAL FOR INSTRUCTIONS REGARDING SETTING THE CHARGER FOR BATTERY TYPE.**

INSTALL THE BATTERIES

WARNING !

Use extreme caution when working with batteries. Sulfuric acid in batteries can cause severe injury if allowed to contact the skin or eyes. Explosive hydrogen gas is vented from inside the batteries through openings in the battery caps. This gas can be ignited by any electrical arc, spark or flame. If battery acid makes contact with your skin or eyes, flush the affected area with water for 5 minutes and seek medical attention.

When Servicing Batteries...

- Remove all jewelry to avoid accidental shorts.
- Do not smoke.
- Wear safety glasses, a rubber apron and rubber gloves.
- Work in a well-ventilated area.
- Do not allow tools to touch more than one battery terminal at a time.
- ALWAYS disconnect the negative (ground) cable first when replacing batteries to prevent sparks.
- ALWAYS connect the negative cable last when installing batteries.

CAUTION !

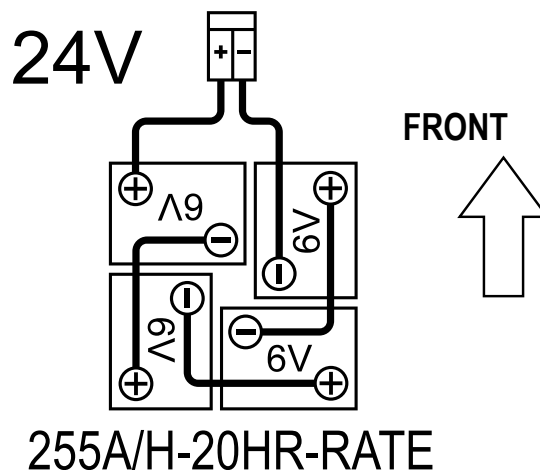
Electrical components in this machine can be severely damaged if the batteries are not installed and connected properly. Batteries should be installed by Nilfisk or by a qualified electrician.

Only batteries approved for use in this machine by Nilfisk shall be installed.

- 1 Empty the Recovery Tank (22) using the Recovery Tank Drain Hose (37).
- 2 Press the Power Switch (B) to power OFF machine and remove the magnetic SmartKey. Unlatch (36) then swing open the Recovery Tank Cover (20) and set the Prop Rod (39).
- 3 Tip the Recovery Tank (22) back towards the operator's platform to expose the battery compartment. Note: The recovery tank can be removed for complete access to the batteries if desired. See service manual for recovery tank removal steps.
- 4 Using (2) people and an appropriate lifting strap, carefully lift the batteries into the compartment tray exactly as shown. Refer to the molded diagram on the underside of the Recovery Tank Cover.
- 5 **See Figure 2-1.** Install battery cables as shown and carefully tighten the nut in each battery terminal until the battery cable will not rotate. Do not over-tighten the terminals, or they will be very difficult to remove for future service.
- 6 Install the battery boots and secure tightly to the battery cables with the supplied tie straps.
- 7 Connect the machine's main power cables to the batteries. Close the recovery tank cover.

When changing batteries or the charger, please contact a local authorized service center for correct battery, charger and machine settings to prevent battery damage.

FIGURE 2-1



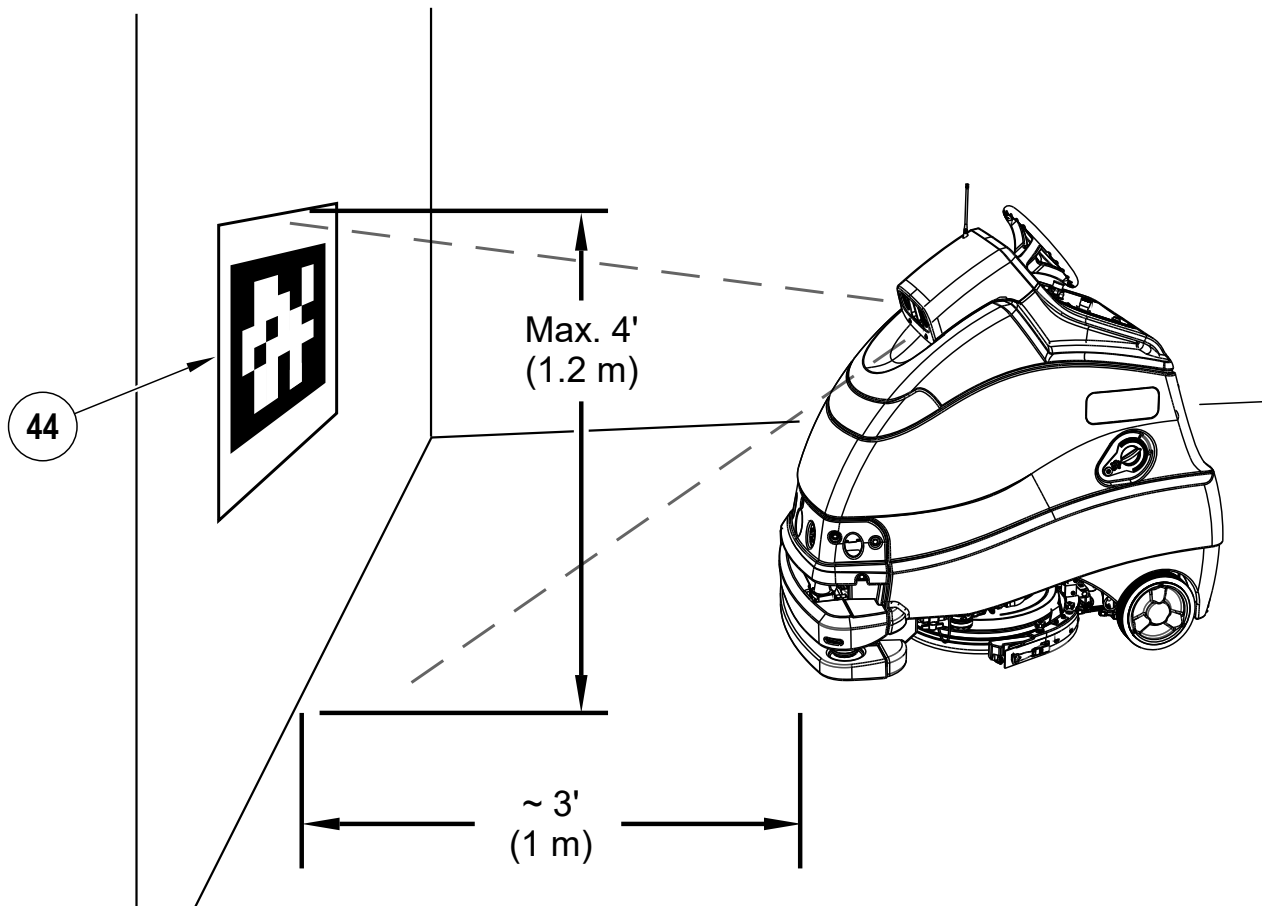
LOCATION TAG

The machine uses a Location Tag to identify its "Home Position" within the building.

IMPORTANT! No plans can be created until the location tag has been installed and identified by the machine.

- 1 **See Figure 2-2.** The Location Tag (44) should be mounted permanently on a wall where the machine will have an unobstructed view of it, preferably near where the machine will be charged every day.
- 2 Place the location tag in an area where there are not movable objects (i.e. garbage cans or other equipment). The machine records information when setting the home position, if there are new obstacles each time within the vicinity of the location tag, the recorded plan will shift.
- 3 Mount the Location Tag to the wall at a maximum height of 4' (1.2 m). This ensures the tag will be within view of the machine's 3-D camera (3-D camera cannot see above the height of the steering wheel). The machine must be driven to the location tag and parked perpendicular to the wall to properly read the tag. Park the machine about 3' (1m) away from the tag.
- 4 The top edge of the Location Tag must be level with the floor.
- 5 If a machine is operated on multiple floors of a building, it will need a unique location tag for each floor. In a building with four floors, four different Location Tags would be required; one for each floor.
- 6 If the area to be cleaned is very large more than one location tag may be needed per floor. Have a location tag within 10-20m of the path start if at all possible.
- 7 If a machine is operated in multiple buildings, it will need a unique location tag for each floor of each building.

FIGURE 2-2

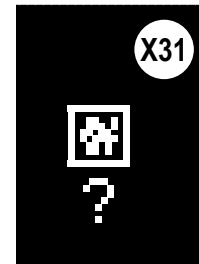


HOME POSITION

• Uncrating the machine for the first time

Follow the steps under “Location Tag” section of this manual to properly affix a location tag (44) to the wall.

- 1 When the machine is uncrated for the first time the Home Position will need to be established.
- 2 The machine prompts operator to Drive to Home Position by displaying the “No Home Set” icon (X31).
- 3 Drive the machine so the location tag is within view of the machine’s 3-D camera.
- 4 Press Autonomy Switch (S) to enter menu.
 - a. Press right arrow to choose “Create home tag”

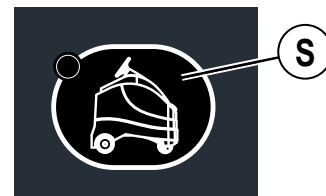


►Need to set home tag!

Create home tag

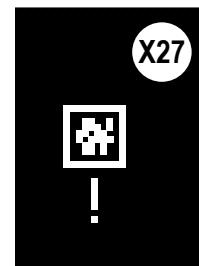
◀Back ▶Select Tag:0 . . *

- b. Press up or down arrow to highlight “Yes”
- c. Press right arrow to “Save”
- d. Display will change and machine will begin actively scanning for a location tag.
- e. After tag is scanned, machine will emit a two tone ascending sound and the display will show location tag ID # (xx).



• Go To Home Position

- 1 Each time the machine is powered ON the home position will need to be reestablished. The machine prompts operator to Drive to Home Position by displaying the “Go to Home” icon (X27).
- 2 Drive the machine so the location tag is within view of the machine’s 3-D camera.
- 3 Machine processes Location Tag (LED Status Bar will be white with blue corners when attempting to read location tag).
 - a. If the Location Tag is recognized the machine will;
 - load the existing map associated with the tag or create a new map if there is no map associated with it.
 - emit a two tone ascending sound.
 - The “Go to Home” icon will disappear from the screen.
 - b. If Location Tag is not recognized or trying to add as a new a tag that is already recognized the machine will;
 - indicate it failed by displaying a fault code
 - emit a slightly longer low sound.
- 4 Machine resumes mapping and returns to normal operation.
- 5 Ideally park the machine facing the location tag. That way when the machine goes through its boot up process, it will automatically find the location tag and be ready to operate.



• Machine transported to a new site or becomes disoriented

- 1 Under normal circumstances, the machine will not lose its orientation except under certain circumstances such as:
 - Being newly uncrated following shipment.
 - 2-D Mapping Laser (14) is covered or requires cleaning.
 - Being transported to a new location, such as from one building to another.
 - Moving to a different floor where another Location Tag controls the scrubbing operation (transported via elevator).
 - Being bumped/moved while the machine is turned off (transported via trailer).
 - Being pushed, towed, or moved by an Operator or spectator while scrubbing autonomously.
- 2 The machine will prompt the operator to “Go to Home” Position by displaying (X27) on the screen.
- 3 Follow the steps in “Go To Home Position” section to scan the location tag and reestablish home position.

NOTE: If machine becomes disoriented happens while in autonomous scrub mode the machine will stop scrubbing and send an alert to the operator via the remote.

MAGNETIC SMARTKEY™

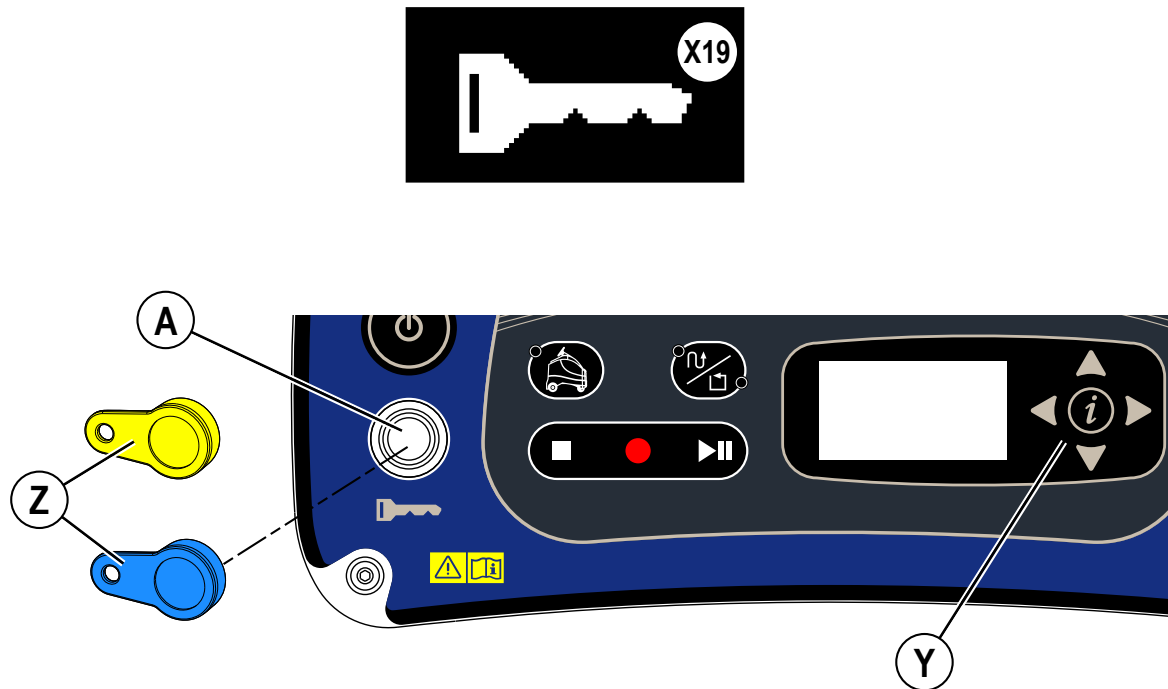
The use of a Magnetic SmartKey™ (Z) is required to operate this machine. Pressing the power switch without a key in place on the SmartKey Reader (A) will cause the machine to momentarily turn on and display No Key Indicator (X19) before turning off.

- a. The key is required at machine startup. If the operator steps off the machine and removes the key, it must be placed back on the reader before machine operation is allowed.
- b. The key can be removed at any time after initial machine start up, but must be removed from the reader before autonomous playback can begin.

There are two different Magnetic SmartKeys (Z).

1. The “User” (blue) key allows a basic level of access to the information menu (press Information Switch (Y)).
2. The “Supervisor” (yellow) key allows an additional level of access.
3. Additional access is available as a “Technician”. The service menu allows observing operational and user parameters. The configuration menu allows adjusting machine settings. See Service Manual for more details.

FIGURE 2-3



INSTALL THE BRUSH (DISC SYSTEM)

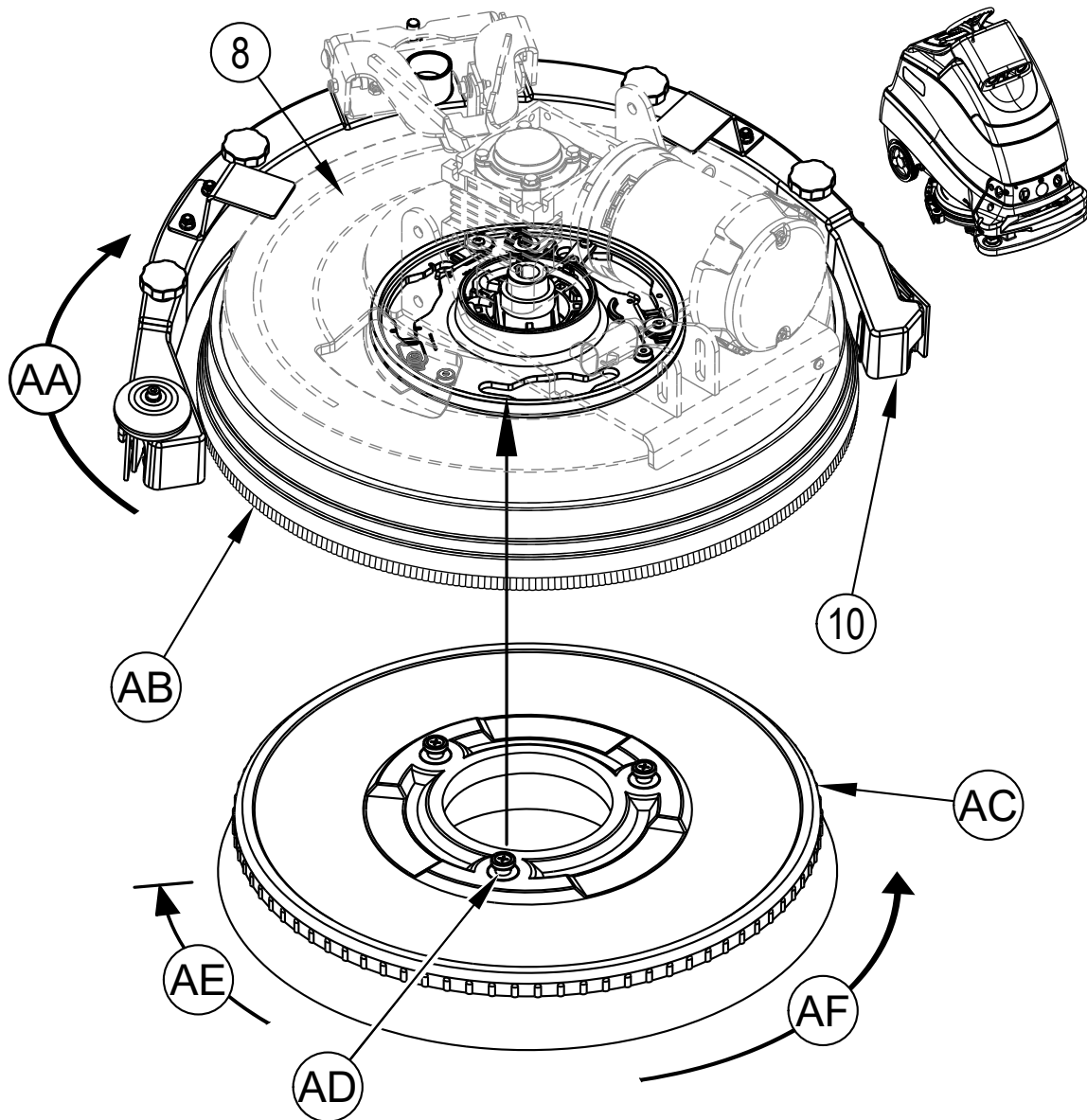
- 1 Verify which brush or pad is appropriate for the floor surface to be cleaned.
- 2 Make sure the Scrub Deck (8) is in the RAISED position. Make sure the Power Switch (B) is off.

⚠ CAUTION !

Turn the machine OFF at the power switch and remove the SmartKey, before changing the brush.

- 3 See Figure 2-4. From the right side of the machine, rotate the Squeegee Assembly (10) towards the left side of the machine to create better access to the brush, (AA).
- 4 Lift the Scrub Deck Skirt (AB) up and slide the brush under the scrub deck.
- 5 If using a pad, install the pad on the pad holder. It uses a central locking device.
- 6 To mount the Brush (AC) (or pad holder) lift the brush and align the Lugs (AD) on the brush with the holes on the mounting plate then turn to lock in place (from the right side of the machine, turn the outside edge of brush towards the rear of machine as shown (AE)). **NOTE:** During operation the brush should rotate in direction (AF).

FIGURE 2-4



INSTALL THE PAD (REV SYSTEM)

- 1 Make sure the Scrub Deck is in the RAISED position. Make sure the Power Switch **(B)** is off.

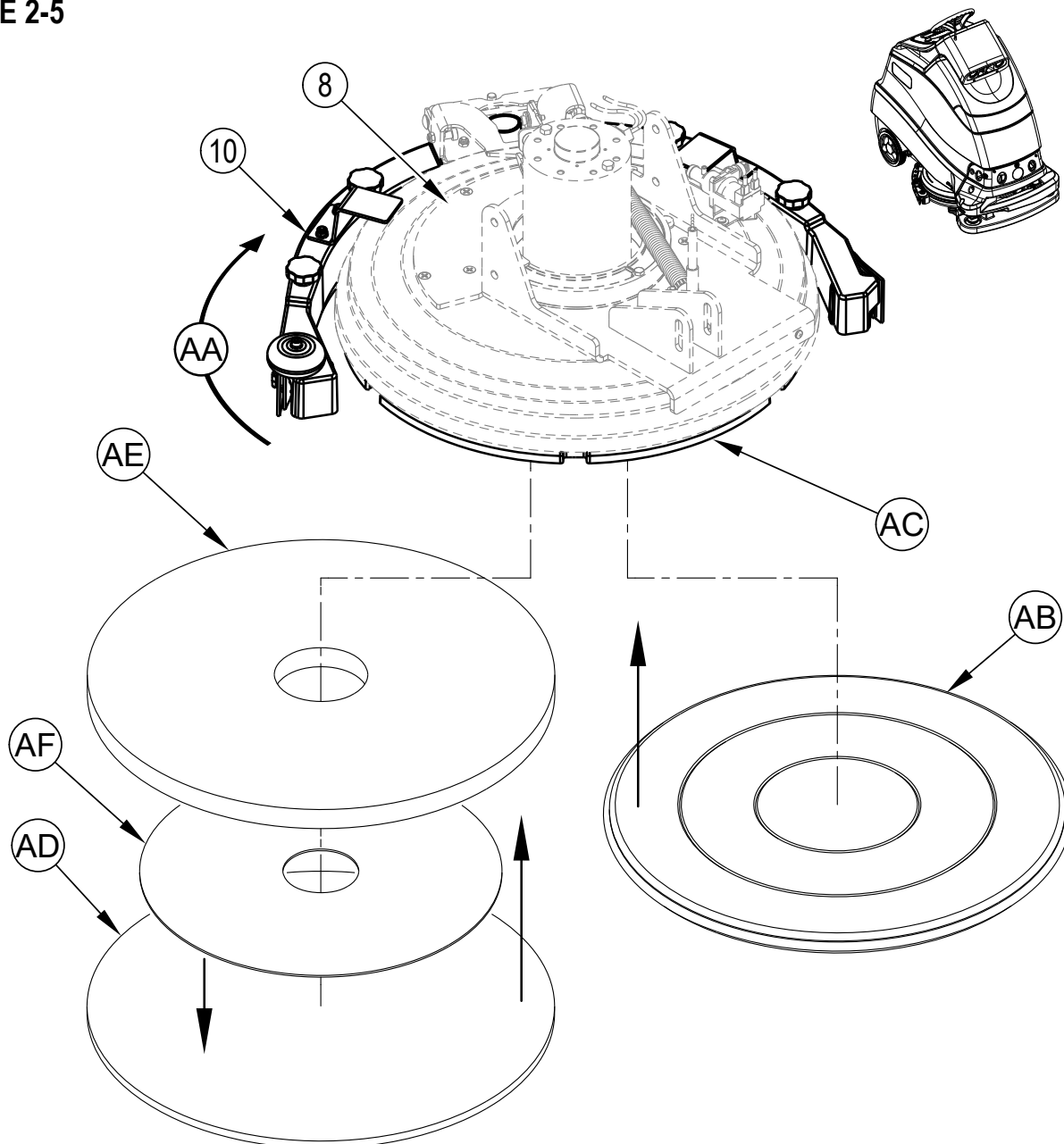
⚠ CAUTION !

Turn the machine OFF at the power switch and remove the SmartKey, before changing the pad.

- 2 **See Figure 2-5.** From the right side of the machine, rotate the Squeegee Assembly **(10)** towards the left side of the machine to create better access to the pad, **(AA)**.
- 3 **Daily Scrubbing:** Slide a daily scrubbing pad **(AE)** or Microfiber Pad **(AB)** under the pad driver, center it on the fixed pad driver **(AC)** and lift it upwards and press it onto the harpoon face of the pad driver.
- 4 **Floor Finish Removal:** Install a new red pad **(AE)** to the pad driver **(AC)** as described in step 3 above. If using the optional double sided Velcro **(AF)**, attach it to the center of maroon SPP pad **(AD)** and slide this assembly under the red pad and center it and then press upwards to attach this assembly to the red pad. If the optional double sided Velcro is not used, install a new red as described in step 3 above and place a new maroon SPP pad on the floor centered on the red pad. Lower the deck to the floor on top of the maroon SPP pad and check that it is centered.

NOTE: Never attach a maroon SPP pad directly to the pad driver, damage to the pad driver will result requiring replacement.

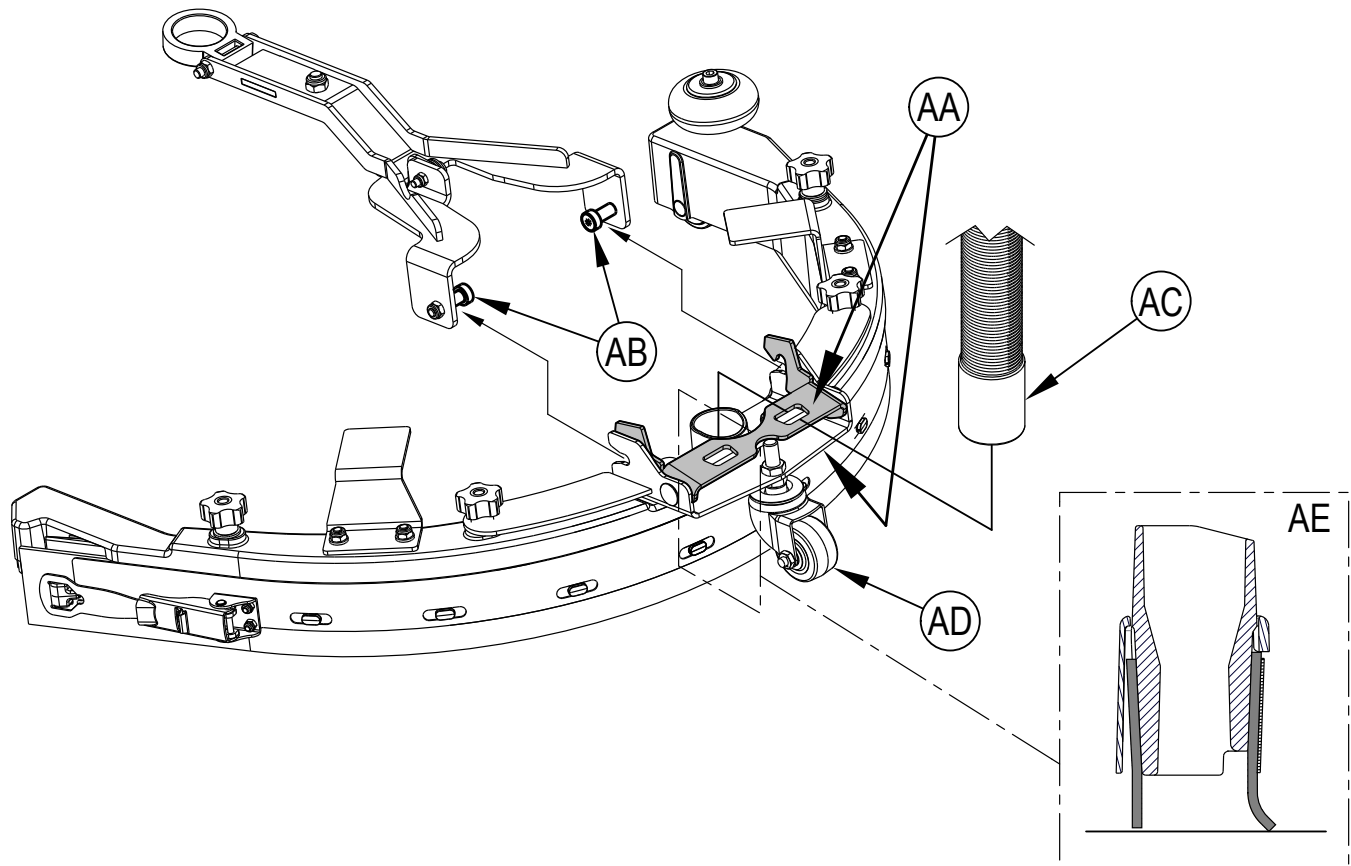
FIGURE 2-5



INSTALL THE SQUEEGEE

- 1 See Figure 2-6. Squeeze the back of the Squeegee Mount Bracket (AA) to open and release the bracket once it's in place over the deck arm Pins (AB).
- 2 Connect the Recovery Hose (AC) to the squeegee inlet.
- 3 Lower the scrub deck and squeegee, move the machine ahead slightly. If necessary adjust the rear squeegee height using the Rear Caster Wheel (AD) so that the rear squeegee blade touches the floor evenly across its entire width and is bent over slightly as shown in the squeegee cross section (AE).

FIGURE 2-6



CLEAN SENSOR LENSES

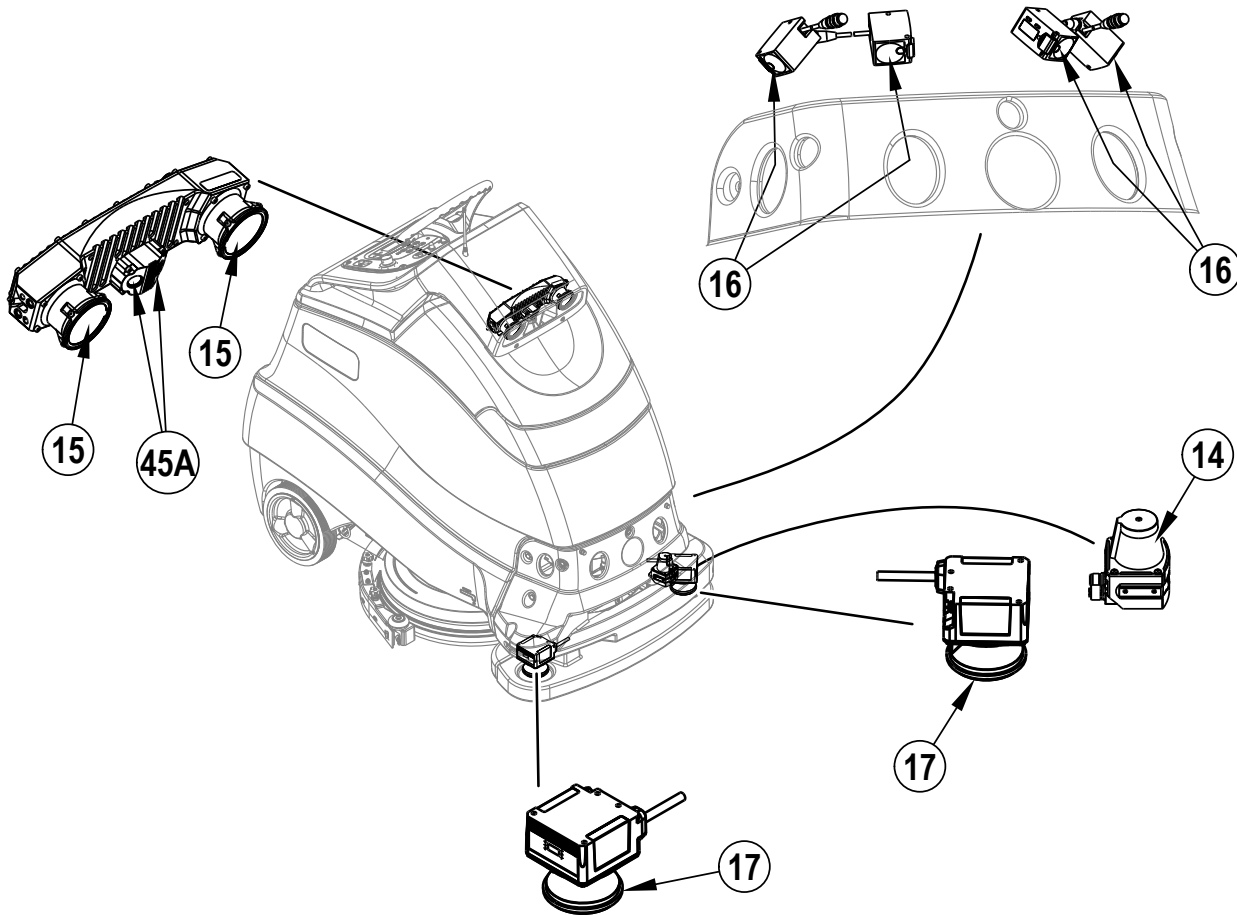
⚠ CAUTION!

Do not use any harsh cleaning detergents or abrasive cleaning agents on the camera and laser lenses or damage may occur.

1 See Figure 2-7.

- Clean 3-D Camera lenses (15) and Infrared source lenses (45A) using an optical grade microfiber cloth dampened with lens cleaning solution.
- Clean all drop-off safety laser lenses (16) using an optical grade microfiber cloth dampened with lens cleaning solution.
- Clean all Safety Laser lenses (16 & 17) using an optical grade microfiber cloth dampened with lens cleaning solution.
- Clean 2-D Mapping Laser lens (14) using an optical grade microfiber cloth dampened with lens cleaning solution.

FIGURE 2-7



FILL THE SOLUTION TANK

Open the Solution Tank Fill Cap (41) then fill the tank with a maximum of 14 US gallons (53 liters) of cleaning solution. The amount of solution in the tank can be observed by looking at the Solution Tank Level Sight Tube (38).

The machine is equipped with EcoFlex a detergent dispensing system. When using this system the solution tank should be filled with plain water. The machine can also be used conventionally with detergent mixed with water in the tank. Always follow the dilution instructions on the detergent container label. The solution should be a mixture of water and the proper cleaning detergent for the job.

⚠ CAUTION!

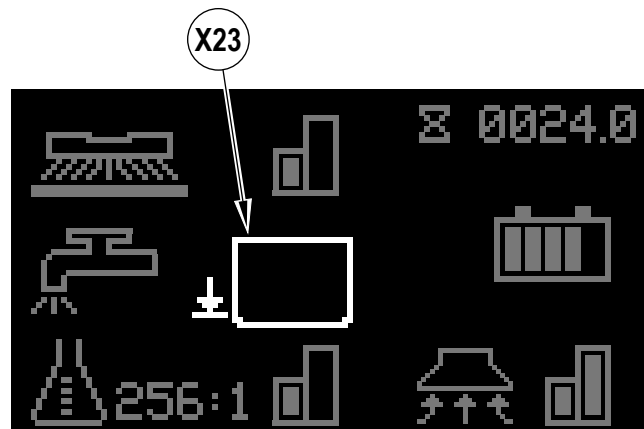
Use only low-foaming, non-flammable liquid detergents intended for automatic scrubber machine applications. Water temperature should not exceed 130 degrees Fahrenheit (55 degrees Celsius).

NOTE: When refilling the solution tank always empty the recovery tank using Recovery Tank Drain Hose (37).

SOLUTION TANK INDICATOR

See Figure 2-8. The solution pump can sense when there is no solution present and send a signal that the solution tank is empty. Once the tank is empty the Solution Empty Indicator (X23) will flash on the display.

FIGURE 2-8



DETERGENT SYSTEM PREPARATION (ECOFLEX)

FILL THE DETERGENT TANK

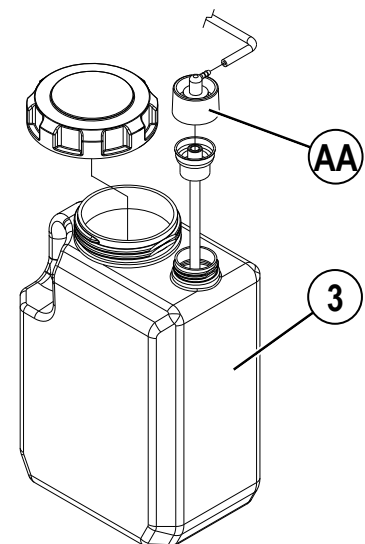
⚠ CAUTION!

Always follow the instructions on the labels of the detergent bottles when using floor cleaning detergents. Wear the appropriate personal protective equipment such as gloves and eye protection when handling floor cleaning detergents. The Detergent Cartridge (3) is located under the Control Panel Housing (20). Fill the detergent cartridge with a maximum of 1 gallon (4 Liters) of detergent. **SERVICE NOTE:** Remove the detergent cartridge from the machine prior to filling to avoid spilling detergent on the machine.

It is recommended that a separate cartridge be used for each detergent you plan to use. The detergent cartridges have a white decal on them so you can write the detergent name on each cartridge for clarification. When installing a new cartridge, remove the factory cap and place the cartridge in the machine. Install the Dry Break Cap (AA) as shown in Figure 2-9.

The system should be purged of previous detergent when switching to a different detergent (see "To Purge When Changing Detergent" in the *Detergent System Use* Section).

FIGURE 2-9



DETERGENT SYSTEM USE (ECOFLEX)

Detergent Ratio (SCRUB AND SOLUTION SYSTEM MUST BE ON):

No detergent is dispensed until the scrub and detergent systems are activated, direction is selected (Q) or (R) and the Go Pedal (24) is pushed.

- The Detergent Indicator (X6) will be displayed in scrub mode when the detergent system is installed on the machine.
- The Detergent Ratio/Percentage Indicator (X7) will display the selected ratio/percentage when the detergent system is on.

There are 4 modes of EcoFlex operation:

- 1A. *Chemical Free Cleaning Mode* - During scrubbing, the detergent system can be turned off at any time by pressing the Detergent Switch (K) to allow scrubbing with water only. Detergent Ratio/Percentage Indicator (X7) will be blank and Detergent Indicator Bar Graph (X8) will display no bars filled. Detergent Light (K1) will be off.
- 2A. *Detergent Low Mode* – Activated by pressing the Detergent Switch (K) when detergent is off (repeated presses will cycle to High Mode, off and back to low mode). Detergent Ratio/Percentage Indicator (X7) will display the current low detergent level and Detergent Indicator Bar Graph (X8) will display first bar filled. Detergent Light (K1) will be on. See below the steps “To program the Detergent Low Level”.
- 3A. *Detergent High Mode* – Activated by pressing the Detergent Switch (K) when detergent is at low mode (repeated presses will cycle to low mode, off and back to high mode). Detergent Ratio/Percentage Indicator (X7) will display the current high detergent level and Detergent Indicator Bar Graph (X8) will display left and right bars filled. Detergent Light (K1) will be on. See below the steps “To program the Detergent High Level”.
- 4A. *Burst of Power Cleaning Mode* – Press the Burst of Power Switch (O) to enter Burst of Power mode. Burst of Power Indicator (X22) will blink for one minute on the display along with a 60 second timer countdown. Press Switch (O) again before 60 seconds to cancel Burst of Power. The amount of time Burst of Power runs is adjustable (see “Information Menu Display” submenu “Options”).
 - Detergent ratio will increase to the pre-programmed “high concentration” detergent level (as noted in programming instructions below). Detergent system will be turned ON at “high concentration” detergent level if it was OFF.
 - Solution flow rate will increase to the next higher level.
 - Scrub pressure will increase to the next level.
 - Vacuum power will increase to the next level, unless the vacuum system is off then it will remain off.

To program the Detergent High Level

1. Press the Information Switch (Y) to enter the information menu Use the four Navigation Arrows (Y1) (up, down, left & right) to move through the menu.
2. Scroll to “Options” and press the right navigation button to enter the Options menu. **NOTE:** Supervisor key required to access Options menu.
3. Scroll down to “Detergent High” press the right navigation button to select the ratio/percentage.
4. Scroll up or down to “Edit” (cycle through) available values: (Note: only ratios/percentages that are a higher concentration than the low detergent setting will be available.

Ratio = 300:1, 256:1, 200:1, 150:1, 128:1, 100:1, 64:1, 50:1, 32:1, 26:1

Percentage = 0.3%, 0.4%, 0.5%, 0.7%, 0.8%, 1.0%, 1.5%, 2.0%, 3.0%, 3.8%.



CAUTION!

Do not use a concentration level exceeding the detergent manufacturer’s recommendation.

5. Once the desired level is displayed on the screen press the right navigation button to “Save” your changes, or the left navigation button to “Cancel” your changes.

To program the Detergent Low Level

1. Press the Information Switch (Y) to enter the information menu Use the four Navigation Arrows (Y1) (up, down, left & right) to move through the menu.
2. Scroll to “Options” and press the right navigation button to enter the Options menu. **NOTE:** Supervisor key required to access Options menu.
3. Scroll down to “Detergent Low” press the right navigation button to select the ratio/percentage.
4. Scroll to cycle through the available options. (Note: only ratios/percentages that are a lower concentration than the high detergent setting will be available.
5. Once the desired level is displayed on the screen press the right navigation button to “Save” your changes, or the left navigation button to “Cancel” your changes.

Once set, the detergent flow rate automatically increases and decreases with the solution flow rate, but the detergent ratio/percentage remains the same.

To Purge When Changing Detergent (SCRUB AND SOLUTION SYSTEMS MUST BE OFF):

SERVICE NOTE: Move machine over floor drain before purging because a small amount of detergent will be dispensed in the process.

1. Disconnect and remove the detergent cartridge.
2. Place the Magnetic SmartKey (Z) onto SmartKey Reader (A). Press the Power Switch (B) to power ON machine. Wait a few seconds for the start-up sequence to finish.
3. Press and hold the Solution Switch (J) and the Detergent Switch (K) down for 2 seconds. Release the switches when the Detergent Purge Indicator (X17) appears on the display (the Detergent Switch Light (K1) and Solution Switch Light (J1) will be ON). **NOTE:** Once activated the purge process takes 20 seconds (timer countdown will display). Press (J) and (K) again before 20 seconds to cancel purge. See illustration on next page for Detergent System indicators. Normally one purge cycle is adequate to purge the system.

To Purge Weekly (SCRUB AND SOLUTION SYSTEMS MUST BE OFF):

1. Disconnect and remove the detergent cartridge. Install and connect a Cartridge filled with clean warm water.
2. Follow steps 2 and 3 from “To Purge When Changing Detergent”.

When the detergent level is nearing the bottom of the cartridge it is time to refill or replace the cartridge.

SERVICE NOTE: Follow the “To Purge Weekly” instructions above if the machine is going to be stored for an extended period of time.