Instruction Manual, Operation and Maintenance
original instructions

PORTABLE IMILK401 LITE

InterPuls

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MODEL	Portable iMilk401 Lite
YEAR OF MANUFACTURE	2017

Summary

1 GENERAL INFORMATION

1.1 General information and safety warnings

1.1.1 Important warnings

To safeguard the operator and prevent any damage to the equipment, before carrying out any kind of operation it is important to have read and fully understood the instruction manual.

1.1.2 Symbol used in this manual

The following symbols are used in this manual to highlight indications and warnings which are of particular importance:

WARNING

This symbol indicates health and safety regulations designed to protect operators and/or any exposed persons.

CAUTION

This symbol indicates that there is a risk of causing damage to the equipment and/or its components.

NOTE

This symbol is used to highlight useful information.

1.1.3 Rules and regulations for the user

WARNING

Any failure to observe the warnings provided in this manual may lead to equipment malfunctions or damage to the system.

1.1.4 Limitation of liability

InterPuls S.p.A. declines all liability for damage to persons, animals and/or things caused by incorrect use of the equipment.

1.2 *Prior using the product*

1.2.1 Requirements and rules for personnel and Safety Rules

WARNING

Before using the device, the operator must carefully read the manual.
The person using the device must be of legal age and be trained and physically and mentally fit. He or she must also have been provided with adequate information on how to operate the device.
During the assembly and activation of the device, follow the instructions in the manual and rules and regulations applying to health and safety at the workplace.

As the Portable ACR-SMART is an operator hand-held device, the operator must wear non-slip safety shoes during use to prevent damage from accidental falls of the device

1.3 Disposal

1.3.1 General regulation

The appliances must be disposed of only and exclusively by specially authorized waste disposal companies in accordance with all relative legislation and prescriptions.
The packaging must be consigned to the relative authorized companies to be recycled.

1.4 Fire prevention

1.4.1 Fire prevention

NOTE

The machine is not equipped with fire extinguishers.

The operator must make sure that the place in which the appliance is installed is equipped with an adequate number of suitable fire extinguishers. The extinguishers must be positioned where they are clearly visible and protected from damage and improper use.

1.4.2 Safety regulations

WARNING

It is strictly prohibited to extinguish fires involving electrical equipment with water!

1.4.3 Characteristic of extinguishers

Use powder, foam or halogen extinguishers which must be positioned next to the device.
Operating personnel must receive adequate instruction on how to use the extinguishers.

1.5 Normative references applied

Europe:

- Directive no. 2004/108/EC Electromagnetic Compatibility (EMC)

1.6 Marking

1.6.1 Dataplates affixed to the machine

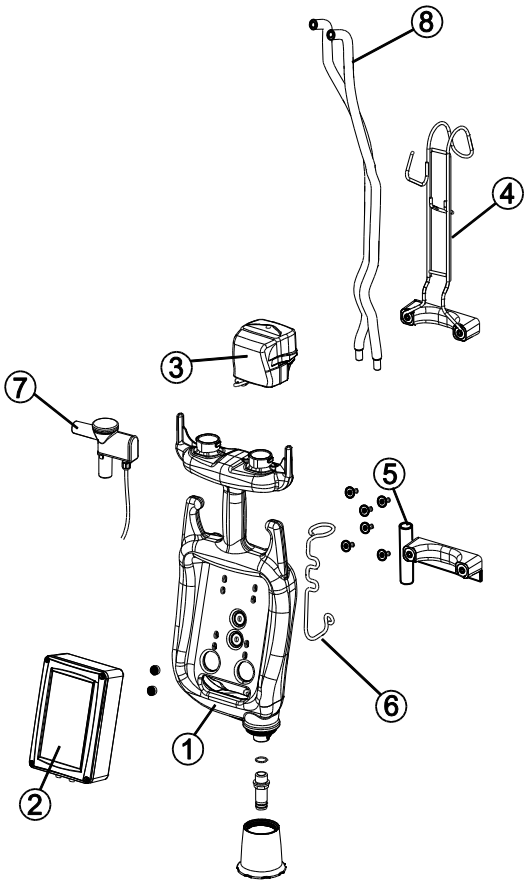
2 DESCRIPTION OF THE MACHINE

2.1 General features

The Portable iMilk401 Lite is a portable milking device with manual shut-off, pulsation control, and metering of the quantity of milk taken, designed for milk transport systems for tied animals.

The package includes (already assembled):

- Plastic frame with built-in 1.5 lt (0.05 ft^3). vacuum tank to have a constant vacuum reserve and in order to reduce vacuum fluctuations (ref. 1)
- 1 iMilk401 Panel to manage milking and to view the quantity of milk that has been milked (ref.2)
- 1 LE 30 pulsator to generate the pulse signal (ref.3)
- Brackets to clamp the components (ref.4-6)
- Bracket with a terminal to fix the milk tube (ref.5)
- Direct passage sensor to measure the flow of milk that has been milked (ref.7)
- A piece of pipe with twin connection terminals (ref. 8)

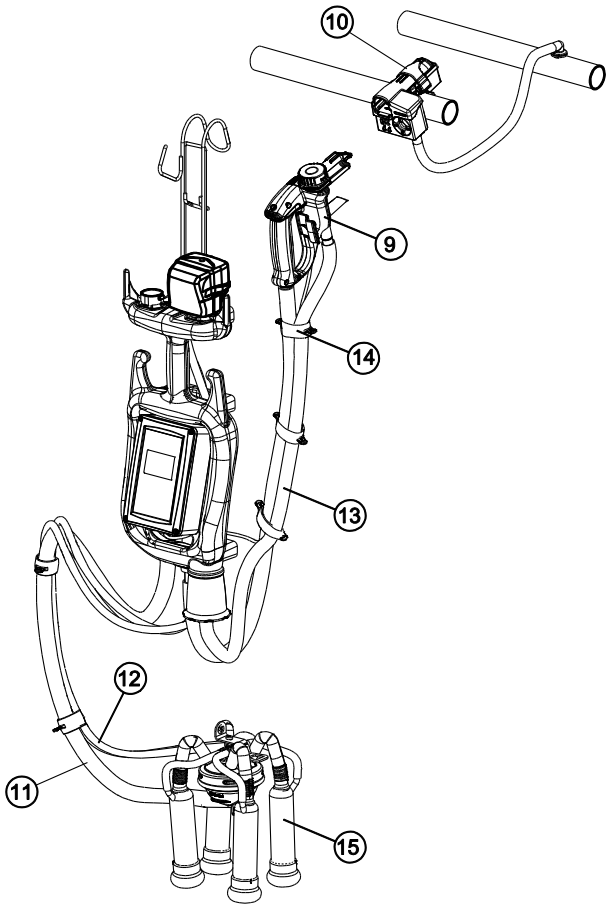


The package does not include the following components, which are supplied separately and which are required for the final commissioning:

- Combifast mobile part (ref.9)
- Combifast fixed part (ref.10)
- Milk tube, twin tube, vacuum tube, retaining ring (ref.11, 12, 13, 14)
- Milking cluster (ref. 15)

The following are the features of the pipes to be used:

1. Milk pipe 16x29 (0.63x1.14 in) (Preferably black)
2. Vacuum pipe 13x23 (0.51x0.9 in) (Preferably black)
3. Twin pipe 7.6x14.5 (0.3x0.57 in) (Preferably black)



NOTE

The individual iMilk401 panels can be connected to the network by means of a CAN-BUS communication protocol, and it is possible to view the milking data via remote PC, which is located in the farmer's office, which has a milking system management software installed (DHM)

CAUTION

The Portable iMilk401 Lite has been designed to work with InterPuls components to complete the installation: the milking cluster design is composed of a Lunik 350 claw and IPL11 liner, and the 3-way connection device is the Combifast. For any other installation with non InterPuls material, the system engineer will be responsible for ensuring proper system commissioning.

CAUTION

The Portable iMilk401 Lite has been designed to operate with the aforementioned pipe sizes. Do not use different sized pipes as such use would compromise the operation of the system

CAUTION

All assembly diagrams and explanations in this manual refer to the use of InterPuls components (Pulsators, Combifast and milking clusters with Lunik 350); InterPuls declines any liability for any malfunction, if the system engineer replaces components not explicitly mentioned in this manual with competitive devices.

2.2 Technical characteristics

Technical Specifications		
Input voltage	24 VDC -5% / +20%	
Protective devices	Inverse polarity protection Inputs and outputs are protected from current overload 4A fuse at the power supply input	
Power consumption	iMilk401 panel	100 mA
	Indicator light to signal the end of the milking process	30 mA
	TOTAL	360 mA
Accuracy when measuring the amount of milk	±10%	
Operating vacuum	between 36 and 60kPa (typically 50kPa) between 10.63 and 17.72 “Hg (typically 14.76 “Hg)	
Operating temperatures (environment)	-5ºC ÷ +40ºC (23°F ÷ 104°F)	
Transport/storage temperatures	-20ºC ÷ +50ºC (-4°F ÷ 122°F)	
Temperature of the washing mixture	Min 60°C - Max 90°C (Min 140°F – Max 194°F)	
Protection class (cables installed correctly)	IP67	
Dimensions (LxLxH)	960 x 250 x 200 mm (37.8 x 9.84 x 7.87 in)	
Device weight	3.5 kg (7.71 lb)	
Weight of the complete device ready for milking operations *	8.0 kg (17.64 lb)	
Maximum weight admissible by the milking clusters **	3.0 kg (6.61 lb)	
Sound pressure	< 70 dB	

**: The weight of the device is considered to be set up with InterPuls unit (composed of Lunik 350 and IPL11 sheaths) and with the 3 way Combifast connecting device for which the system has been explicitly designed*
***: should you wish to apply a unit supplied by the competition, weight refers to that of the claw, teat cup shells and liners.*

3 INTENDED AND NON-INTENDED USE

3.1 Intended use

The Portable iMilk401 Lite is a portable milking device with manual shut-off, with pulsation control and measurement of the quantity of milk that has been milked, designed for milk transport systems for tied animals (cows).

The device is moved by the operator from one milking location to another in 2 possible ways:

1. Hand transport
2. Track transport

WARNING

The Portable iMilk401 Lite is a portable machine that must work under supervision.

WARNING

The machine must be used only for appropriately lit milk transport systems (at least 300 lux)

3.2 Non-intended use

The Portable iMilk401 Lite is not intended for use in milking sheds.

Use of the Portable iMilk401 Lite is not intended for milking animals other than cows.

No other handling of the machine is intended other than the aforementioned.

WARNING

Any use other than the one covered in this manual is considered improper use and is therefore forbidden. InterPuls S.p.A. declines any liability associated with any use of the machine other than the one covered in this manual.

4 RESIDUAL RISKS

WARNING - ELECTRICAL AND FIRE-PROTECTION SAFETY

The machine must be powered by 24VDC through SELV and PELV circuits in compliance with applicable regulations.

The electrical system to which the machine is to be connected must have the following protection:

<u>For protection against indirect contact:</u>

the machine must be supplied by means of an electrical system having a differential circuit breaker connected to the earthed system according to the standards and laws in force.

<u>For protection from machine overloads:</u>

a suitable overload protection device is to be installed against overloads (circuit breaker), which interrupts the circuits once the machine's nominal current has been exceeded.

WARNING

HANDLING

During handling operations of the Portable iMilk401 Lite, the device may fall and accidentally hit the operator.

To overcome this residual risk, the operator must wear the P.P.E. indicated in this manual.

WARNING

WASHING

During system washing, the operator may come into contact with the washing mixture that can reach 90°C (194°F) and with washing acids.

To overcome this residual risk, the operator must wear the P.P.E. indicated in this manual.

WARNING

MAINTENANCE

During pulsator maintenance operations the operator may come into contact with the coils that can reach 80°C (176°F).

To overcome this residual risk, the operator must wear the P.P.E. indicated in this manual.

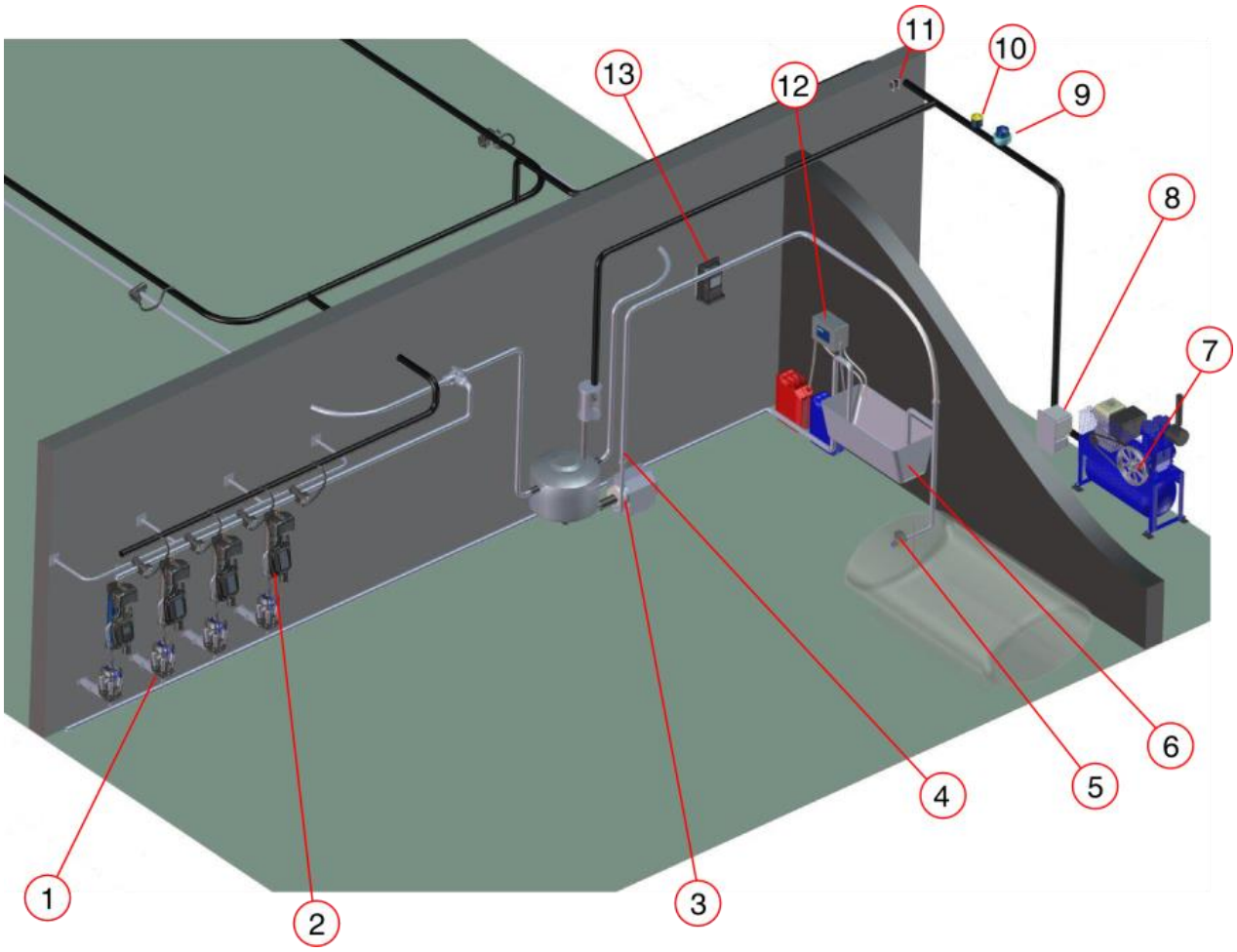
WARNING

PERSONAL PROTECTIVE EQUIPMENT

	**Use safety shoes for machine handling**
	**Use gloves for safer handling of the machine and maintenance operations**
	**Use safety glasses and gloves during the washing phase, where it is possible to come into contact with washing acids.**

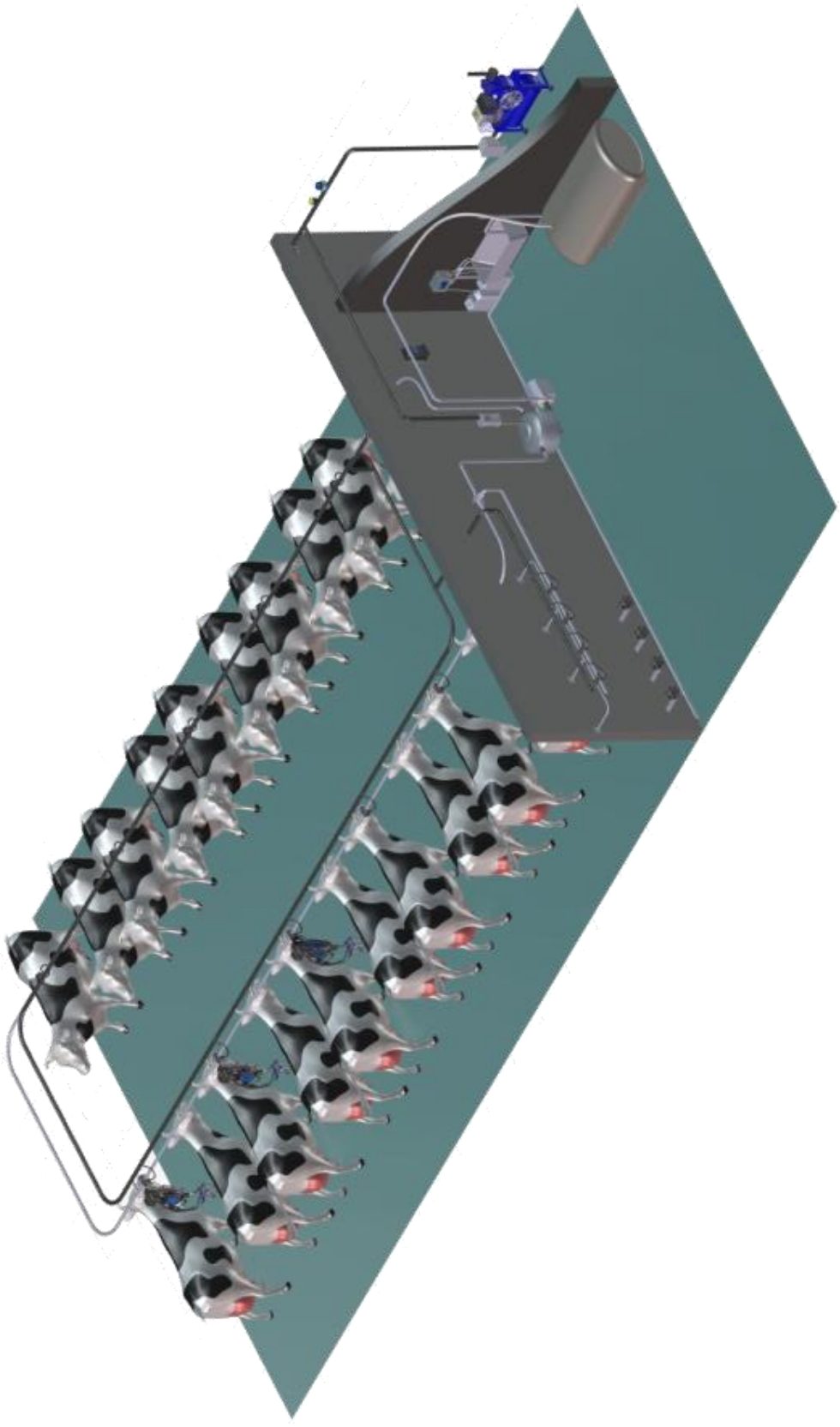
5 SYSTEM

5.1 Washing mode



1	Washing plates
2	Portable iMilk401 Lite
3	Milk pump
4	Milk filter
5	Drainage valve
6	Water tank
7	Vacuum pump
8	Inverter (iDrive100)
9	Vacuum adjustment valve (Stabilvac)
10	Sanivac
11	Vacuum gauge (DVG500)
12	Washing machine (Top Wash III)
13	Power unit (IUP)

5.2 Milking mode



6 FIRST USE OF THE MACHINE

6.1 General description

Before using the machine, you need to make some pneumatic and electrical connections and know the correct uses of the Portable iMilk401 Lite.

This paragraph illustrates:

1. how to insert the tube retaining rings
2. how to carry out pneumatic connection between the Portable iMilk401 Lite and the Combifast mobile part
3. how to carry out pneumatic connection between the Portable iMilk401 Lite and the milking clusters
4. the pneumatic connection diagram
5. the iMilk401 panel connection diagram

WARNING

Do not connect power supply before all cabling has been completed and the iMilk401 box has been closed correctly.

Do not connect anything when the Portable iMilk401 Lite is connected to the network.

NOTE

This manual only shows how to connect the Combifast mobile part to the iMilk401 and how to make the electrical connection. For details on assembling the Combifast, refer to the specific product manual.

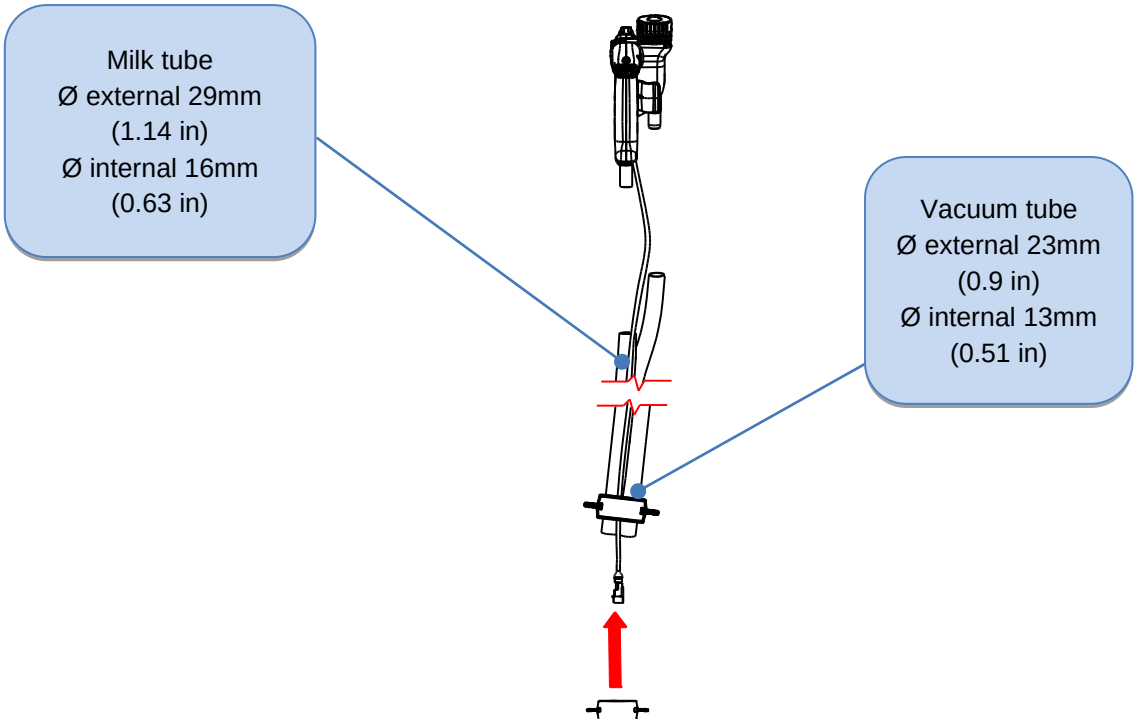
NOTE

This manual shows how to connect the milking cluster correctly to the iMilk401. The procedure for milking cluster assembly is left to the system engineer as it is not covered by this manual.

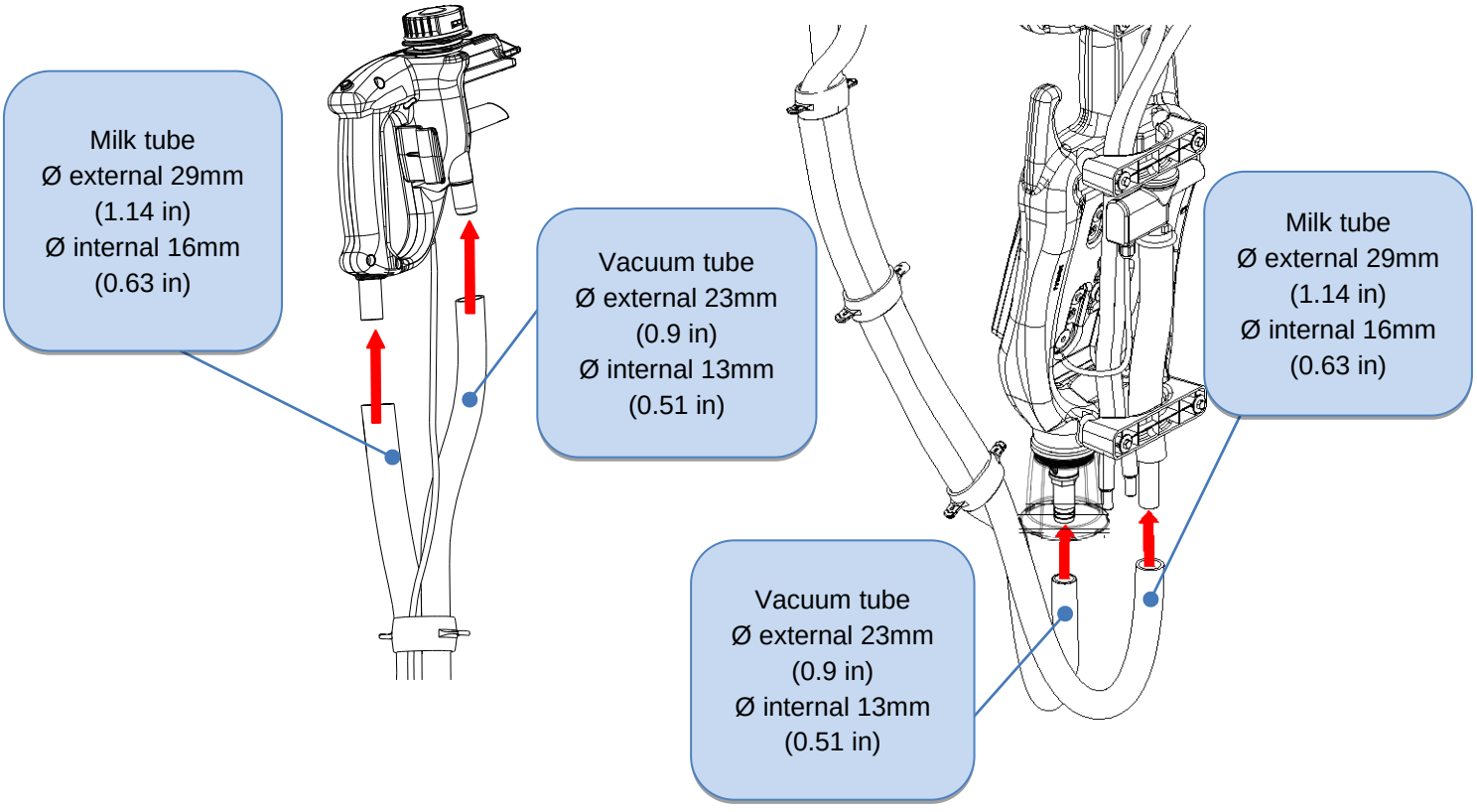
6.2 Pneumatic Connections

The following is the assembly sequence of the Combifast mobile part, milking cluster, long milk pipe, vacuum pipe and twin pipe.

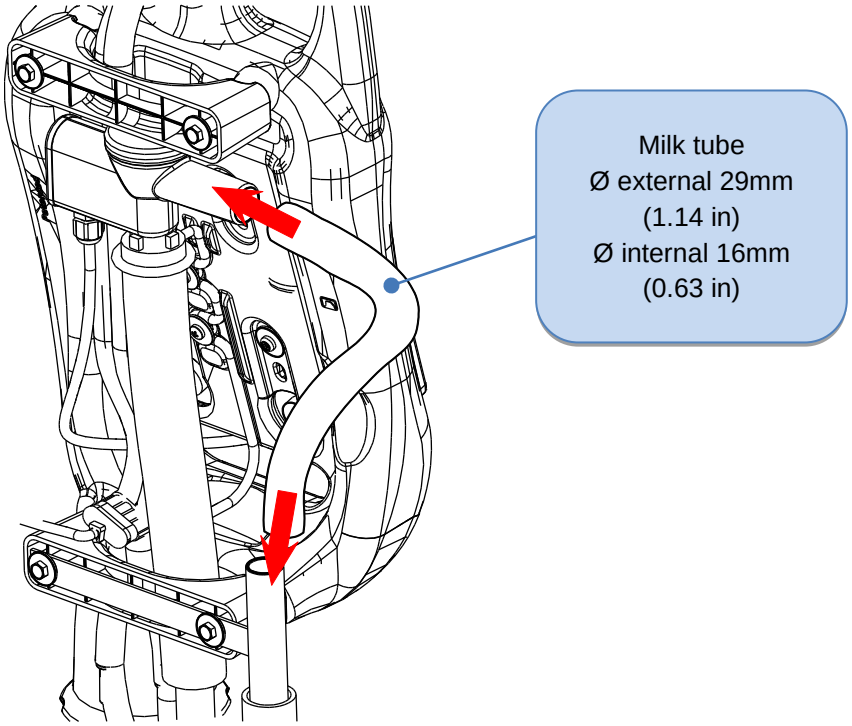
1. **Retaining ring insertion**



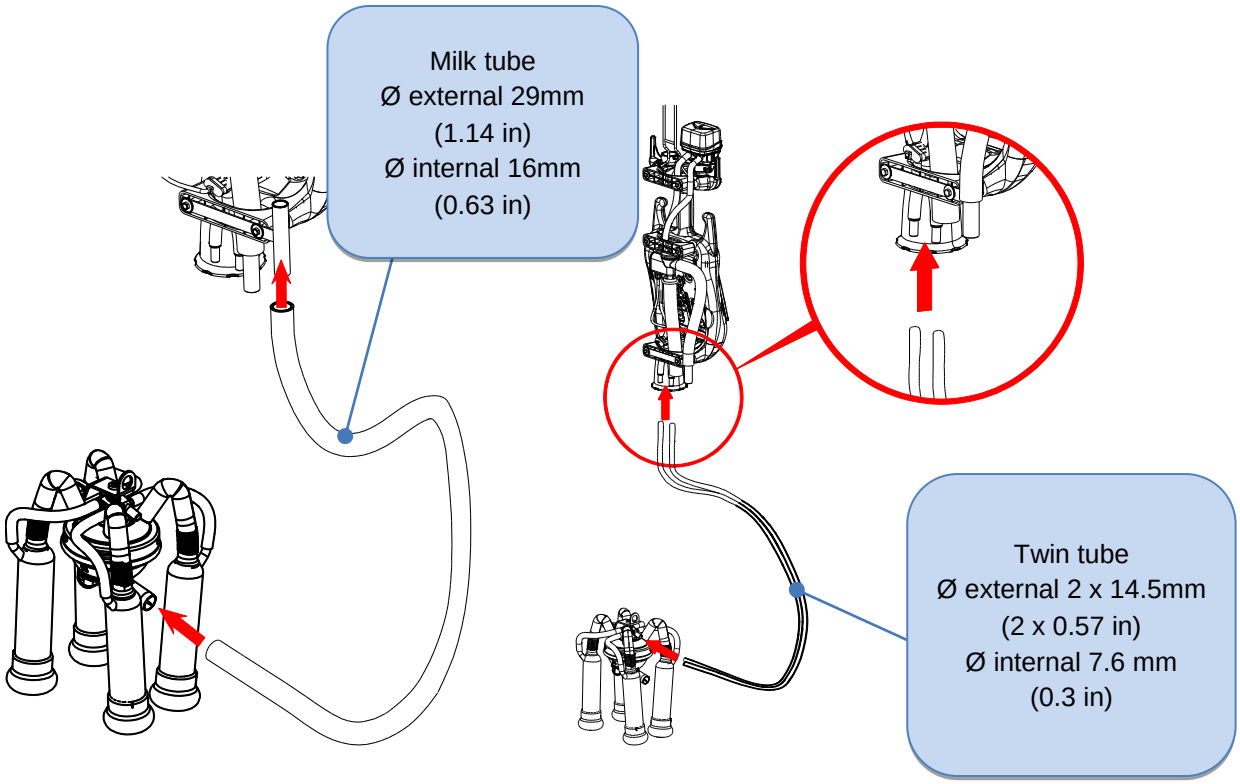
2. **Connection of the milk tube and vacuum tube between the Combifast and the Portable**



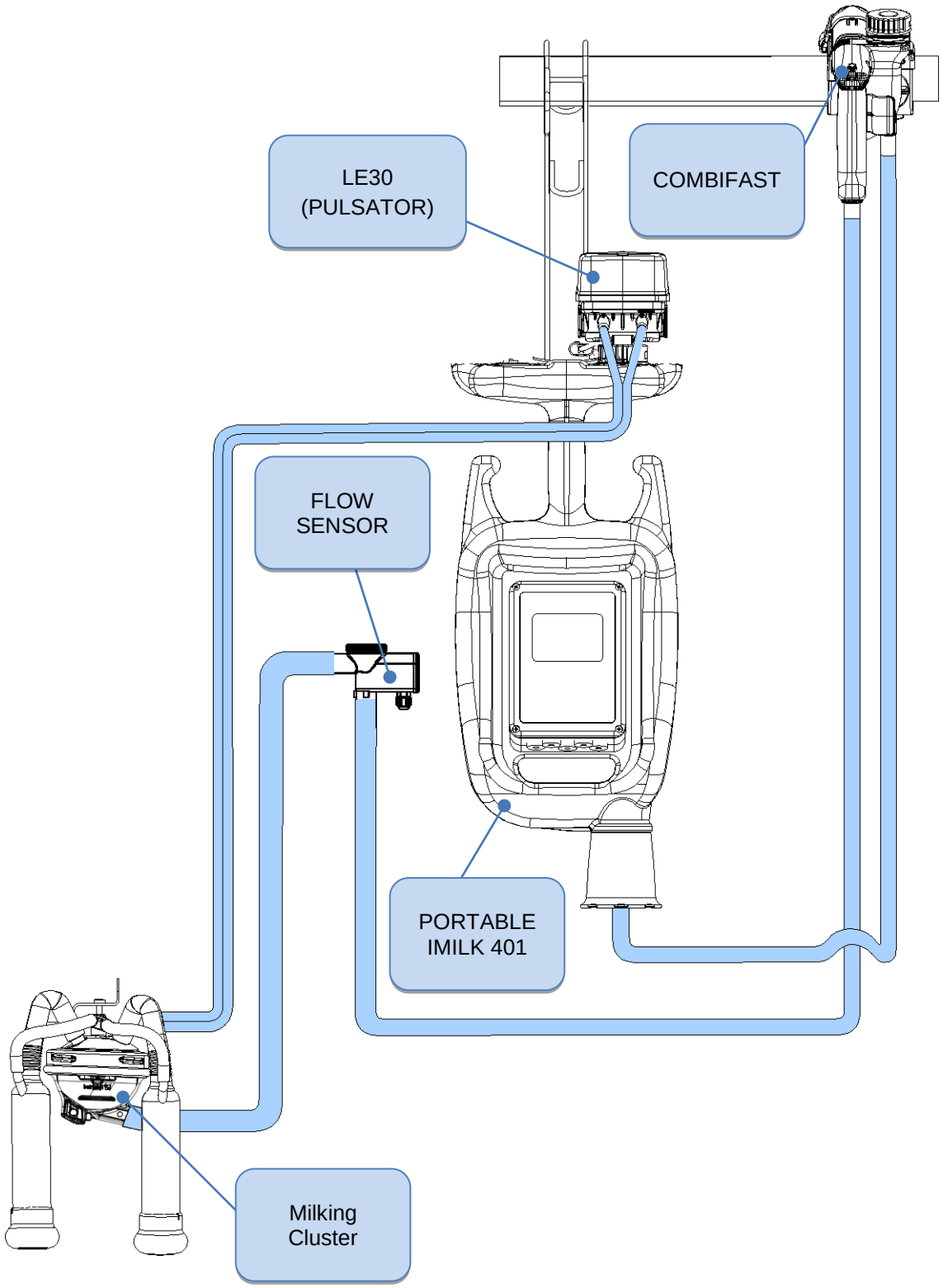
3. Sensor connection (already provided by InterPuls)



4. Connection between the milking cluster and the Portable

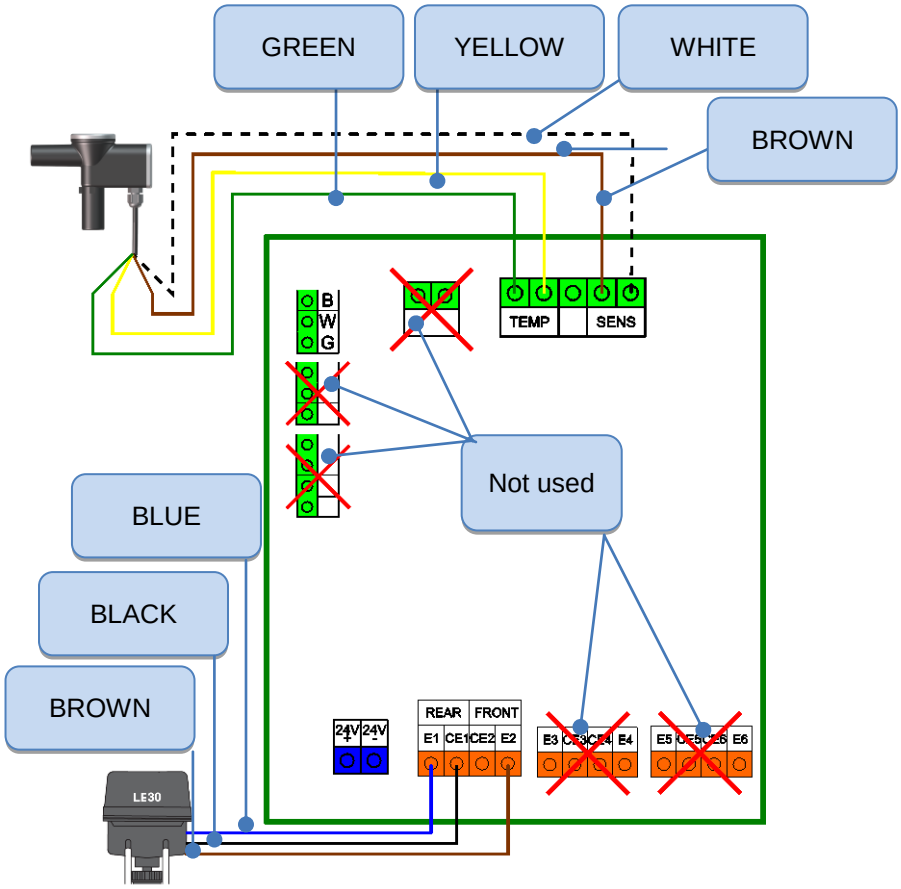


5. Pneumatic connection diagram



6.3 Electrical connections

6.3.1 iMilk401 - Components

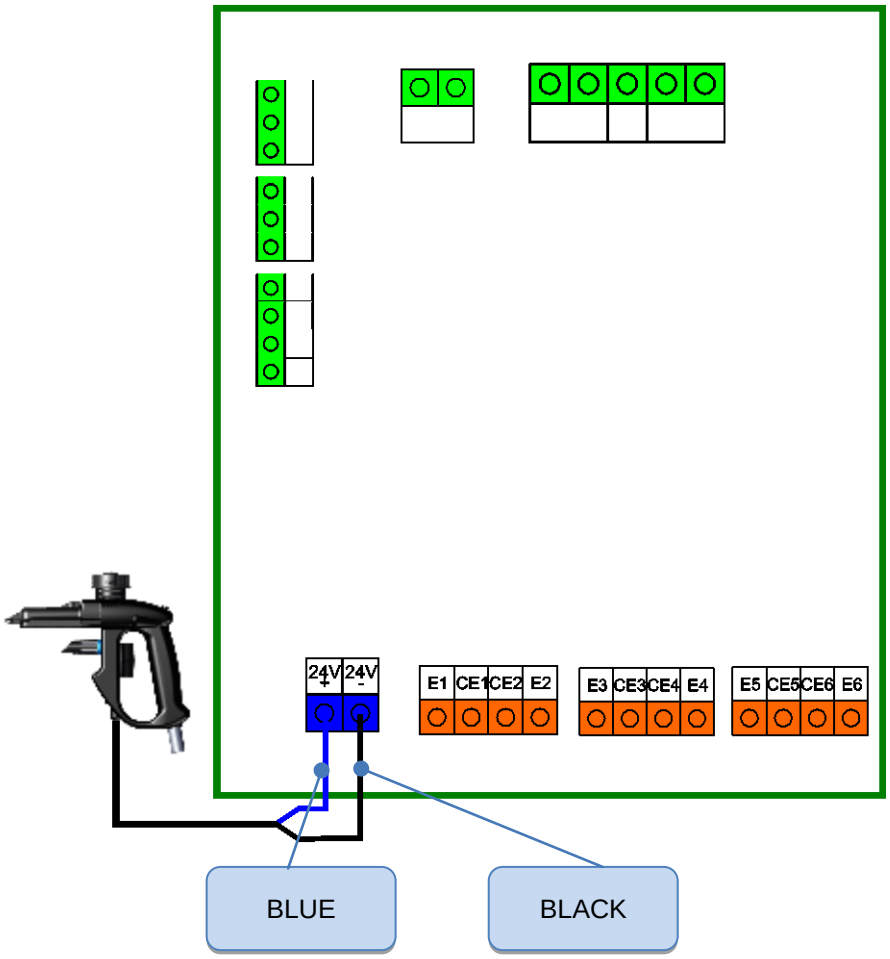


	Terminal	Description	Cable Colour
LE30	E1-R	Rear Pulsations	Blue
	CE1	Common Rear	Black
	CE2	Common Front	Not used
	E2-F	Front Pulsation	Brown
SENSOR	TEMP	TEMPERATURE PROBE	Green
	TEMP		Yellow
	PROBE	SENSOR	Brown
	PROBE		White

6.3.2 iMilk401 connection - Combifast mobile part without data download

Should the DHM milking data management software not be available, proceed as follows for connection.

Undo the 4 screws of the iMilk401 box and open the front panel, being careful not to pull the cables already connected. Pass the 2-pole cable coming from the Combifast pistol through one of the free cable glands and connect it as indicated in the following image.

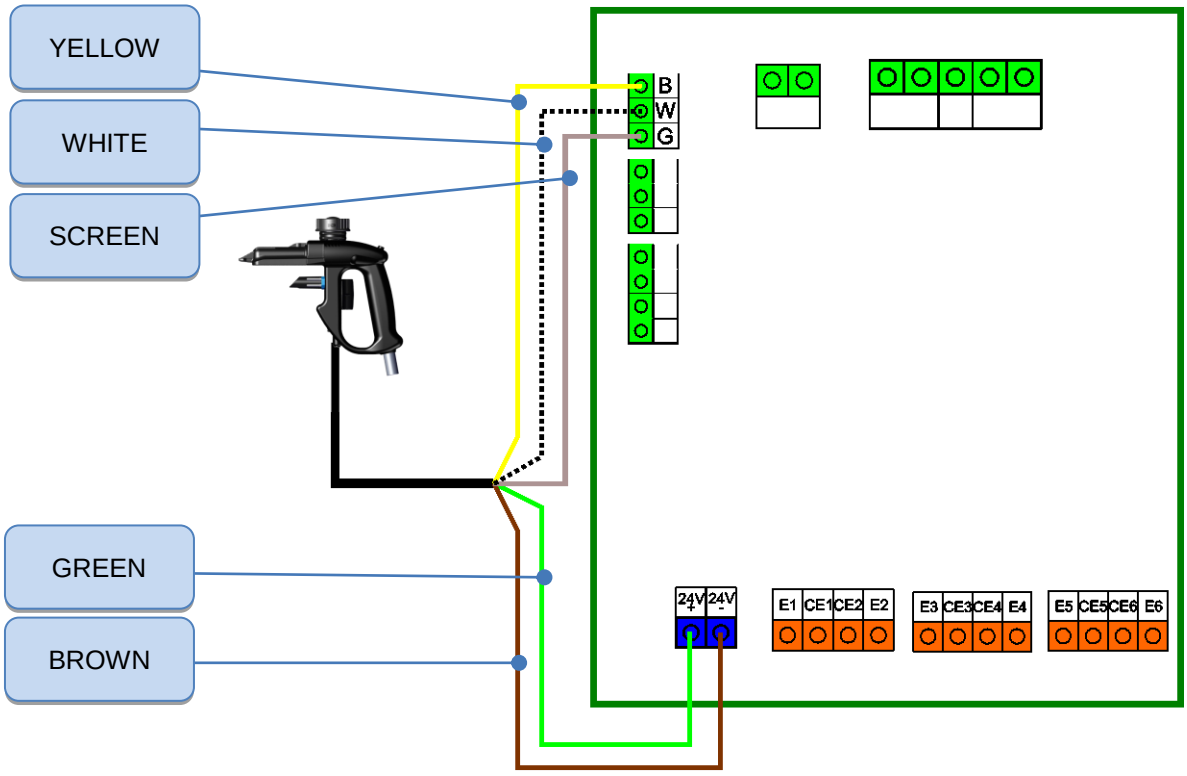


	Terminal	Description	Cable Color
POWER SUPPLY	SUPP.	24V +	BLUE
	SUPP.	24V -	BLACK

6.3.3 iMilk401 connection Combifast mobile part with data download

Should the DHM software be available and data transfer is required, the cable coming from the Combifast pistol will be a 4-pole shielded type. In this case, connect the conductors as indicated in the following image

	Terminal	Description	Cable Color
POWER SUPPLY	+24VDC	24VDC POWER SUPPLY	GREEN
	-24VDC	CAN BUS	BROWN
SUPPLY	B	DATA DOWNLOAD	YELLOW
	W	DATA DOWNLOAD	WHITE
	G	DATA DOWNLOAD	SCREEN



6.4 Combifast fixed part

The Combifast is a coupling system that allows you to temporarily connect to the milk line, vacuum line, power supply and data transfer. It consists of a fixed part (ref.14) assembled on the milk line and a mobile one (ref.13) connected directly to the Portable iMilk401 Lite.

NOTE

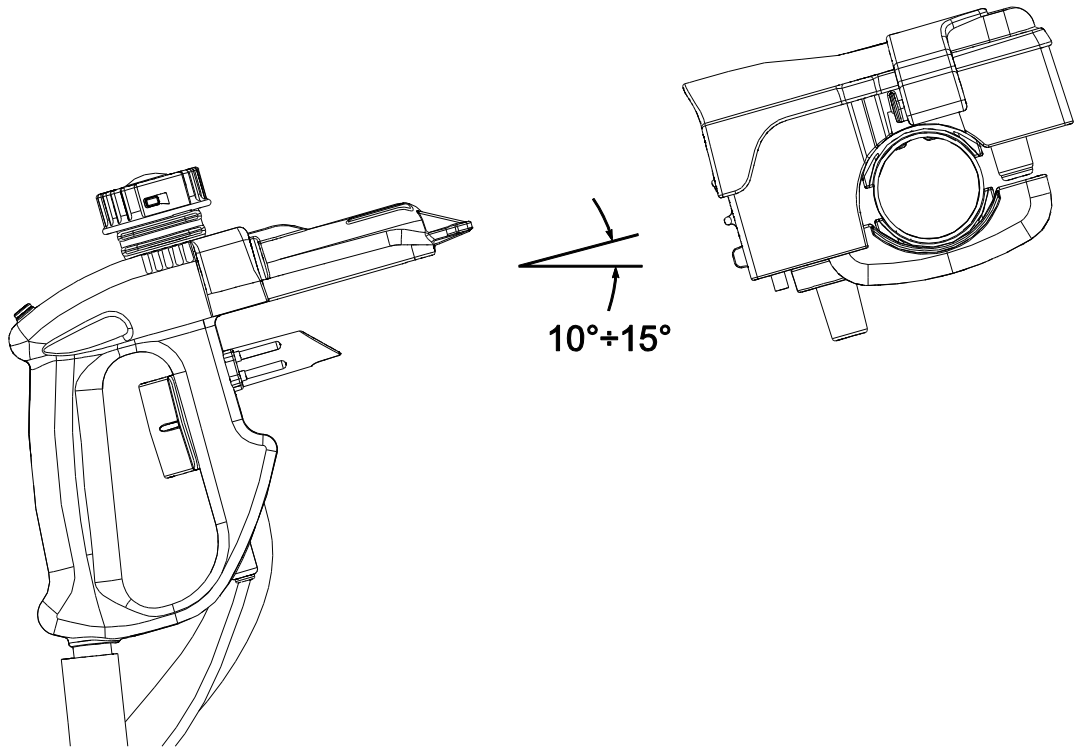
This manual only shows how to connect the Combifast mobile part to the Portable iMilk401 Lite and how to electrically connect them with each other. For details on assembling the Combifast, refer to the specific product manual.

NOTE

This manual shows how to properly connect the milking cluster to the Portable iMilk401 Lite. The procedure for milking cluster assembly is left to the system engineer as it is not covered by this manual.

NOTE

An inclination of 10 ~ 15 ° for the mobile part with respect to the horizontal plane, in order to facilitate insertion.

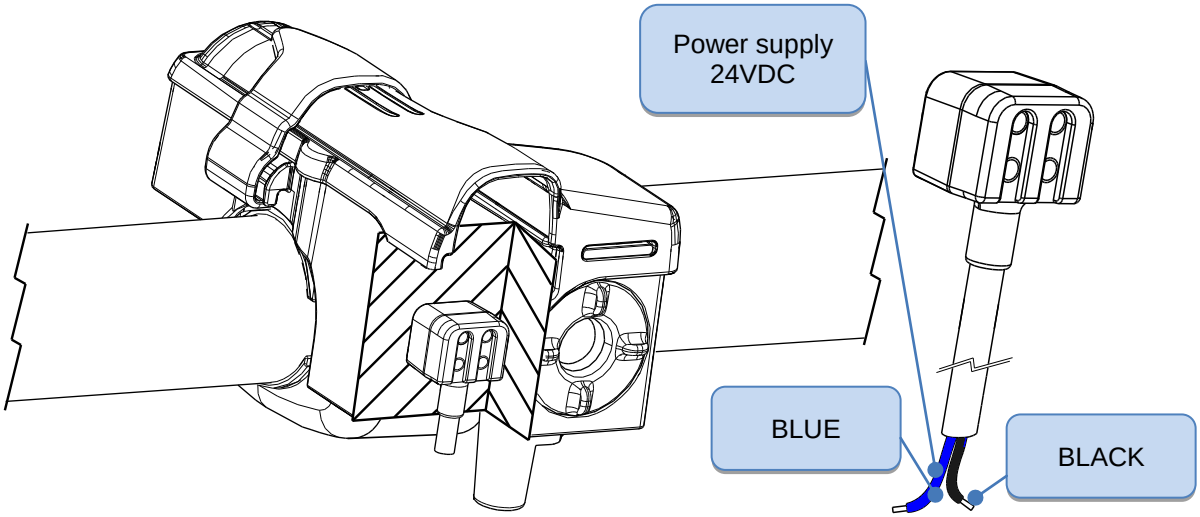


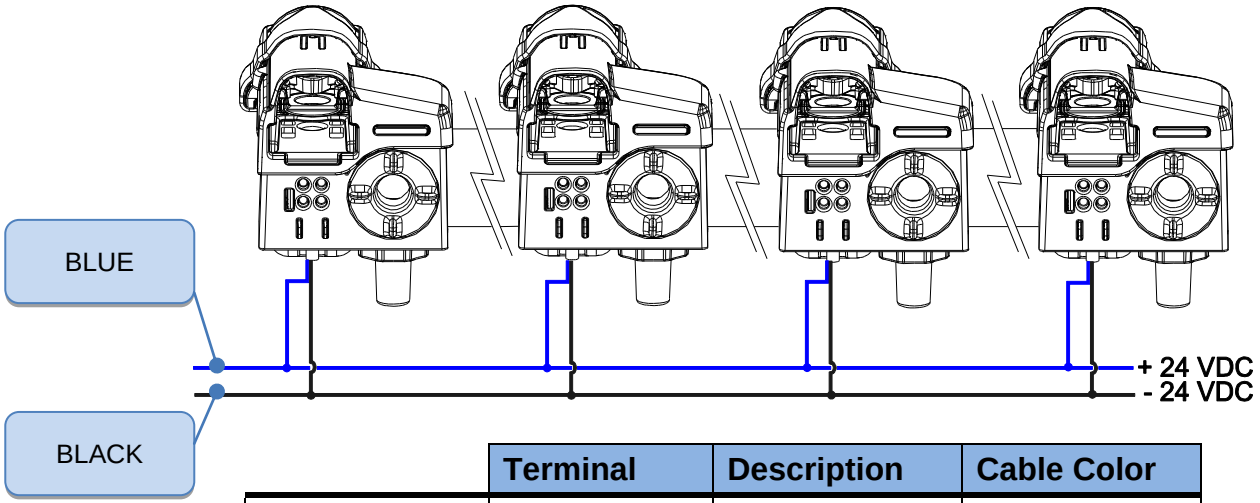
6.4.1 Connection of the Combifast fixed part during washing

A fixed part should be prepared in the washing area for each Portable iMilk401 Lite to enable simultaneous washing of each milking cluster. When washing each Portable iMilk401 Lite (if provided), download the milking data to the DHM software.

6.4.2 Washing the Combifast fixed part without data download

Should data download not be required, all you need to do is connect the BLUE and BLACK cables to the 24VDC power supply.

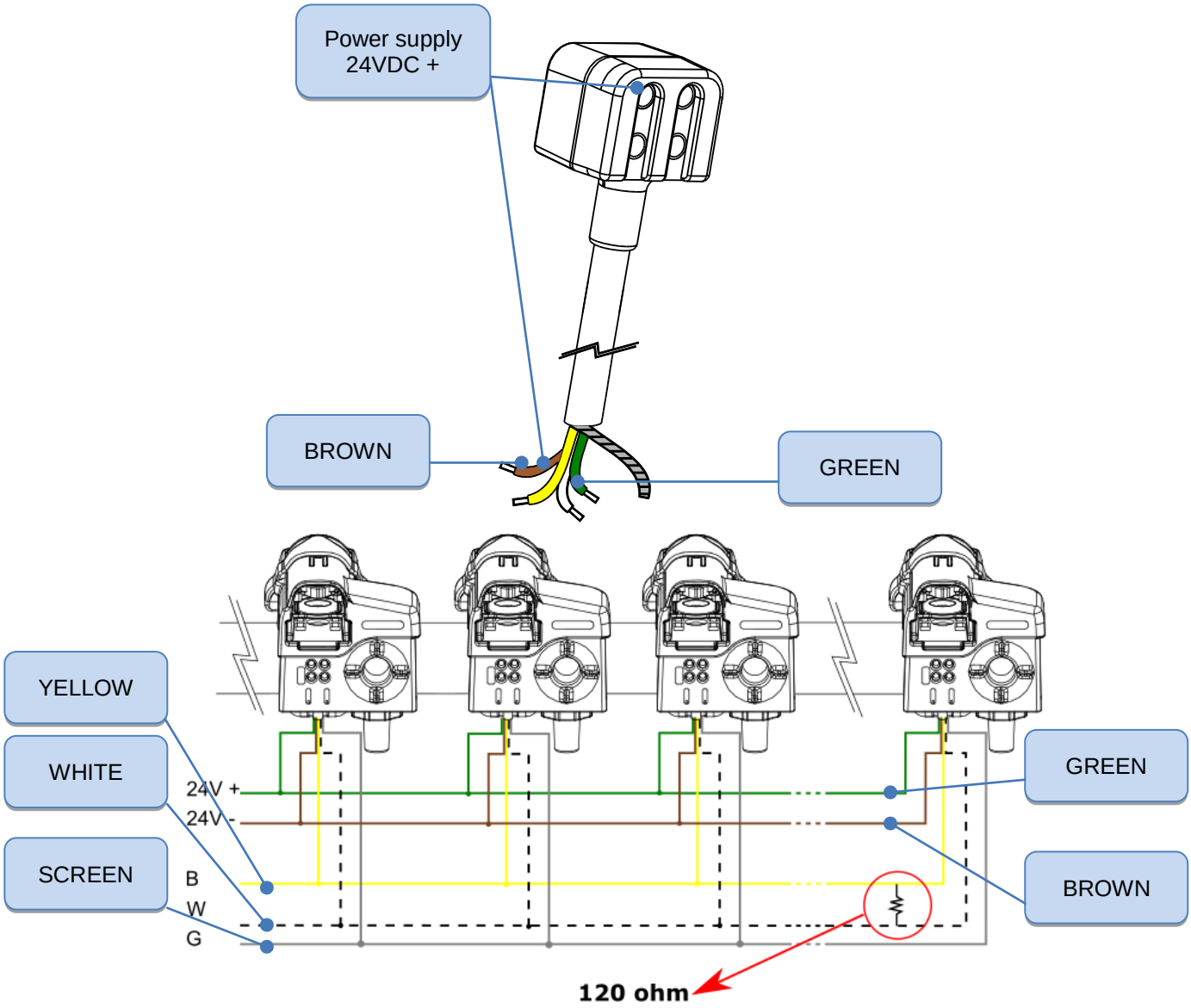




	Terminal	Description	Cable Color
POWER SUPPLY	SUPP.	24V +	BLUE
	SUPP.	24V -	BLACK

6.4.3 Washing the Combifast fixed part with data download

Should a CAN line be connected to the PC with the DHM software, you are required to connect the brown and green power supply cables as well as the yellow, white and relative shielding to download data.



WARNING

Insert a 120 Ohm resistor between the yellow cable and the white cable of the last washing station

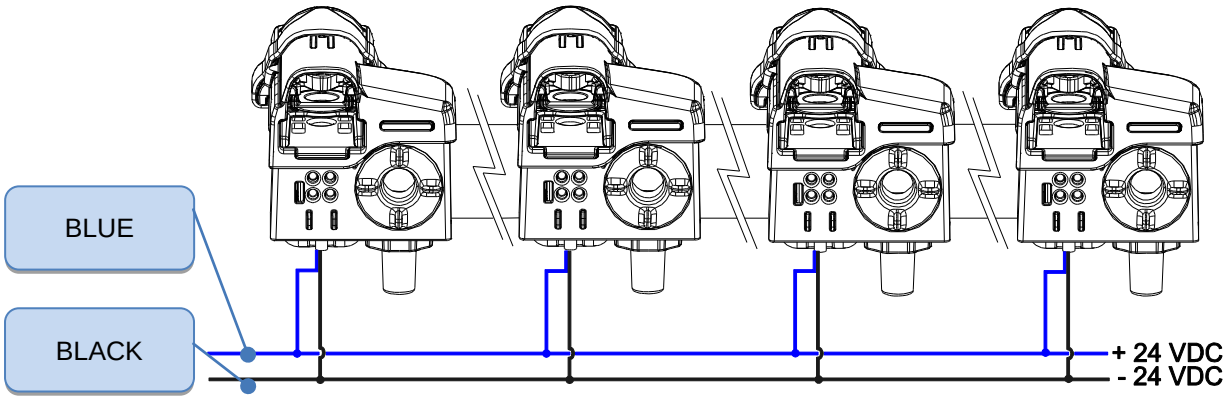
	Terminal	Description	Cable Colour
POWER SUPPLY	+24VDC	SUPP.	GREEN
	-24VDC	SUPP.	BROWN
SUPPLY	B	DATA DOWNLOAD	YELLOW
	W	DATA DOWNLOAD	WHITE
	G	DATA DOWNLOAD	SCREEN

6.4.4 Connection of the Combifast fixed part in milking

You are required to install a fixed part in the milking area on the milk line between every two animals. Each fixed station must be connected to 24VDC power supply.

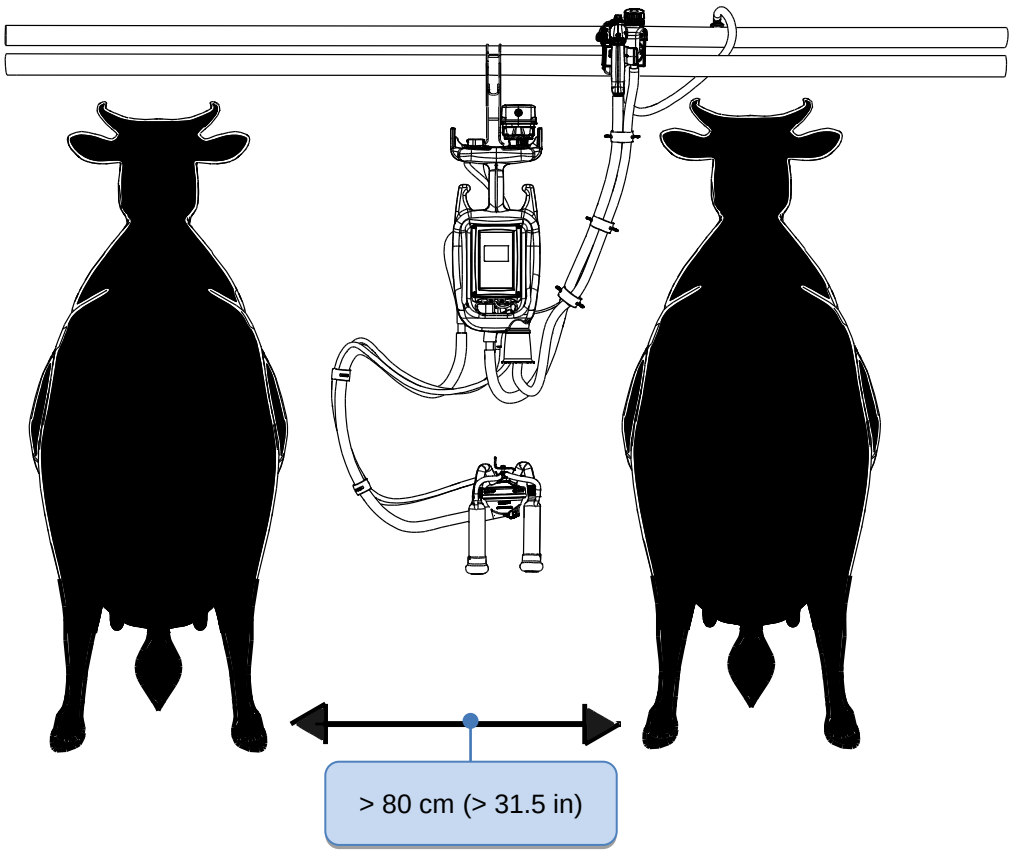
NOTE

You are not required to connect the CAN BUS cable in the fixed part of the Combifast installed for milking.



NOTE

For correct positioning of the Portable iMilk401 Lite in milking, it is necessary to position the Combifast fixed part towards the cow to the right



6.5 Positioning of the Portable iMilk401 Lite during milking

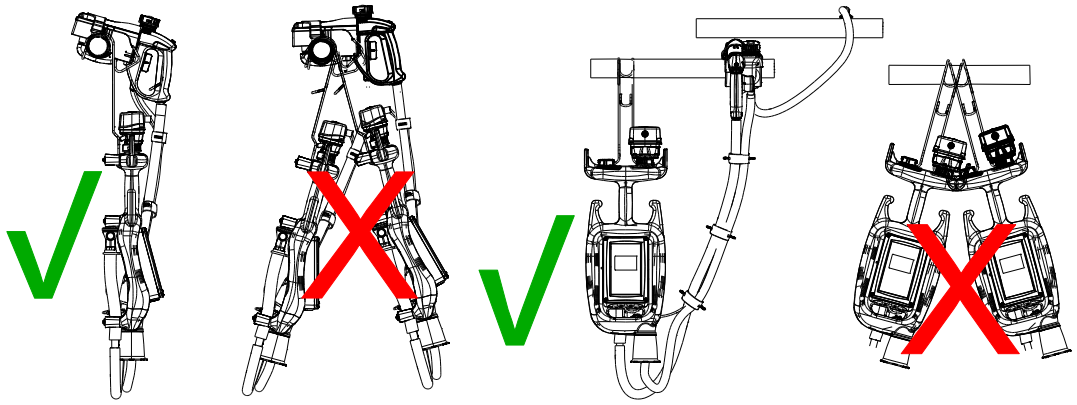
A fixed part on the milking line needs to be installed in the milking area every two animals and it is advisable for a Portable iMilk401 Lite to be used every 5 fixed stations for approximately 2 hours of milking. If you wish to speed up milking, it is necessary to increase the number of Portable iMilk401 Lite in relation to the number of fixed parts.

For proper operation of the Portable iMilk401 Lite device, it is normally clamped on the milk tube between one animal and the next in correspondence with the fixed parts. If the system is on tracks, the Portable iMilk401 Lite must be left on the tracks between one animal and another.

CAUTION

During milking, ensure that:

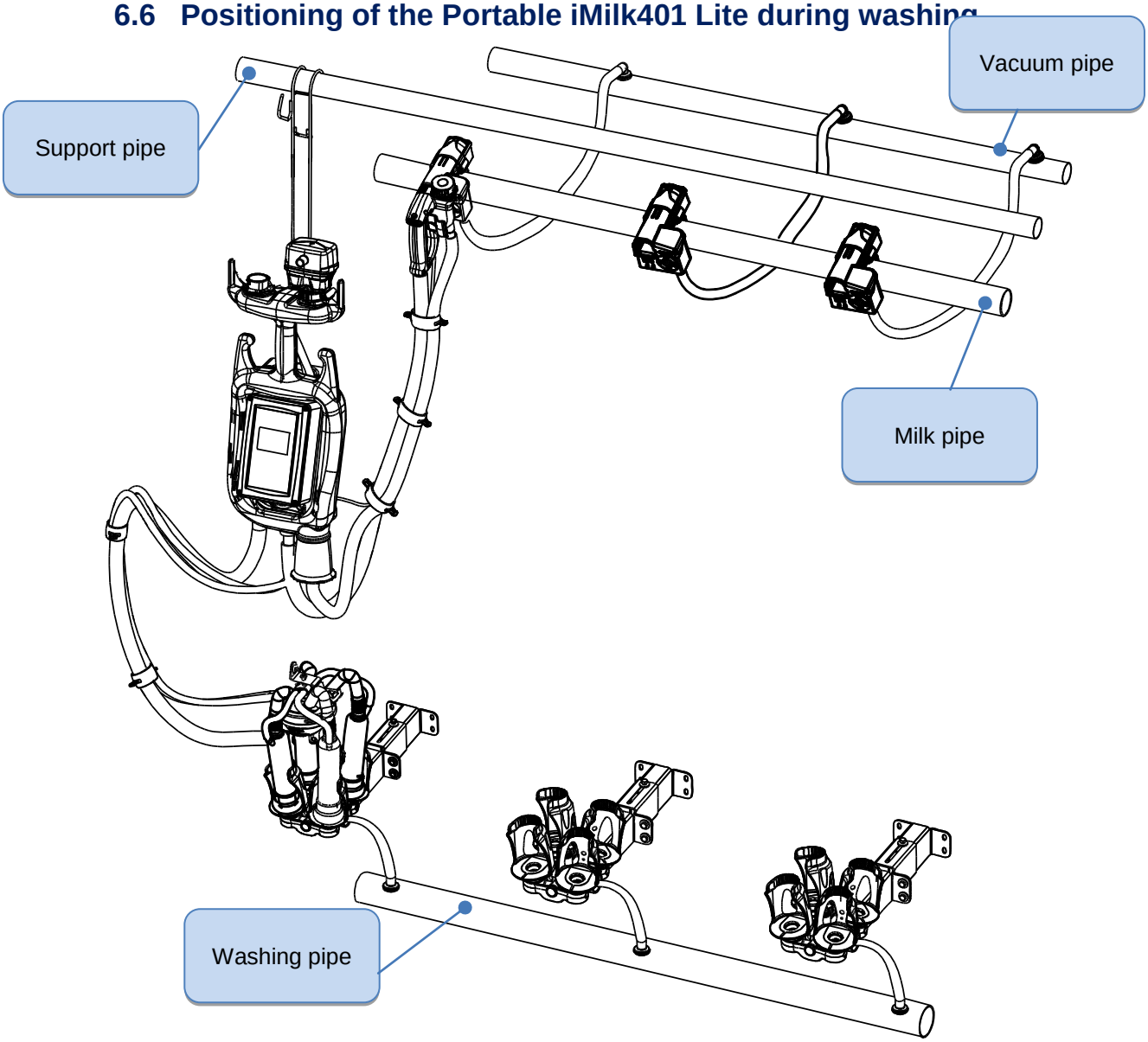
- **The system is vertical and is not pulled in a sloping position by the animal. If the system works in a sloping position, it may experience accuracy problems when reading the quantity of milk obtained in milking.**



CAUTION

The Portable iMilk401 Lite is designed with a quick coupling system to the tubing to facilitate milking, and is designed to withstand accidental falls; if such falls occur frequently (e.g. with every milking due to the animals causing the cluster to release from the support system), the system may be exposed to damage. It is the engineer's task to check that the system is not often knocked to the ground by the animal and, if necessary, to prevent the animal from doing so.

6.6 Positioning of the Portable iMilk401 Lite during washing



Should the DHM software be present, download via CANBUS network will start as soon as a Portable iMilk401 Lite is connected to the fixed part of the Combifast assembled in the washing shed (the said station must be powered). Data download takes a few seconds for each panel.

To download milking data correctly, do as follows:

- Keep the fixed part of the Combifast powered and connect the various Portable iMilk401 Lite, one at a time, waiting for the previous panel to terminate data download between one connection and another
- Keep all fixed parts of Combifast disconnected, connect all Portable iMilk401 Lite and then supply power to all washing stations.

CAUTION

Do not remove the Combifast and do not remove power supply during data download.
Do not connect other Portable iMilk401 Lite before the previous panel has terminated its data download.

6.7 Handling of the Portable iMilk401 Lite

Transporting the Portable iMilk401 Lite from one milking point to another may be carried out in two ways:

- By hand by the operator
- Using track transport systems

WARNING

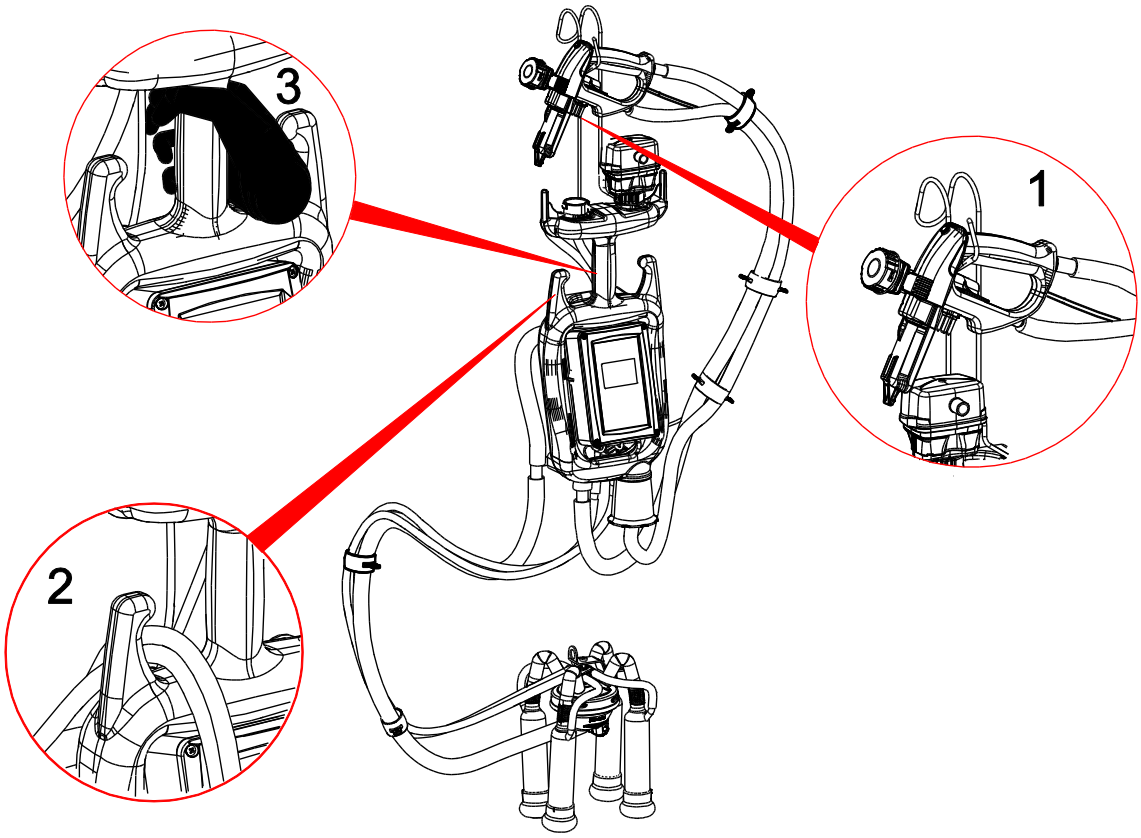
The Portable iMilk401 Lite is also provided with coupling to a track system. InterPuls does not supply such a system, and it is the engineer's task to ensure that the track system is safe and does not cause system malfunctions.

WARNING

During device transport between one milking and another:

- **Position the CombiFast in the special transport support (ref. 1)**
- **Ensure that the milking cluster has the locking ball positioned in the special transport bracket**
- **Ensure that the milk tube and vacuum tube do not hinder the operator from walking when they are placed on the special supports (ref. 2)**
- **Hold the device as shown in the figure (ref. 3)**

Failure to follow these safety instructions could result in injury to people.



6.8 Adjustment for first use

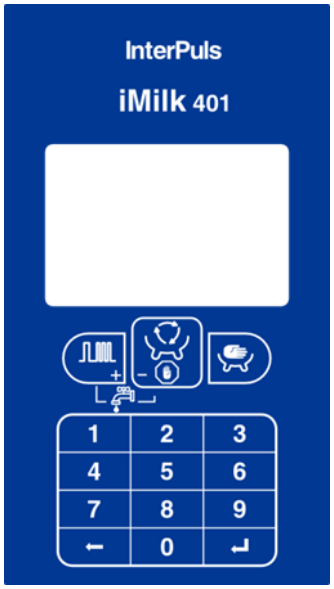
Before using the machine for the first time, the following adjustments need to be made:

1. Adjustment of the milking vacuum acting on the control valve (typically for milk transport systems, set to 50kPa – 14.76 “Hg)
2. Adjust the panel parameters. The main parameters to adjust for correct milking are:
    - Flow level for detachment (Par 17): determines the milking flow that passes on to the DETACHMENT phase

7 IMILK401 OPERATION PANEL

The iMilk401 system is a milking panel that has the following features:

- Milk production measurement for each animal and milking station
- Up to 45 memorized milking
- Pulsation control
- Manual and forced stimulation
- 5 different customizable milking programs
- Milk and washing temperature control
- Conductivity control

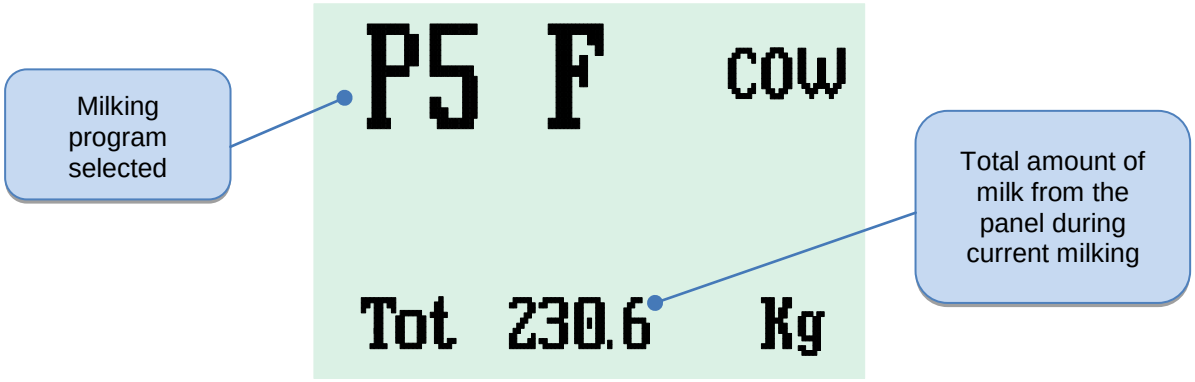


0 ÷ 9	- Insertion of the animal number to milk (if you have the DHM software)
↵	- Confirmation of the animal number input
	- start and stop milking - scroll the parameters - decrease the value of the parameters
	- enable transfer from automatic milking to manual - display the summary of parameters currently set (starting from detachment) - confirm the modified parameter value
+ +	Pressing the two keys simultaneously enables you to - start the washing phase (starting from the detachment phase) - enter the programming mode (starting from the summary of set parameters)
+	- change the milking program - activate manual stimulation - scroll the parameters - increase the value of the parameters
←	- delete the last digit of the animal number being entered - exit the programming menu

7.1 Detachment

During standby (or detachment), the panel waits with the pulsator off. During this phase you can carry out the following operations:

- Start milking
- Start washing
- Insert the number of the animal to be milked, in order to transfer data to the DHM software
- Change the milking program
- Change the panel parameters



Pressing the key takes you to the following milking program (***Lock Programs*** parameter needs to be disabled).

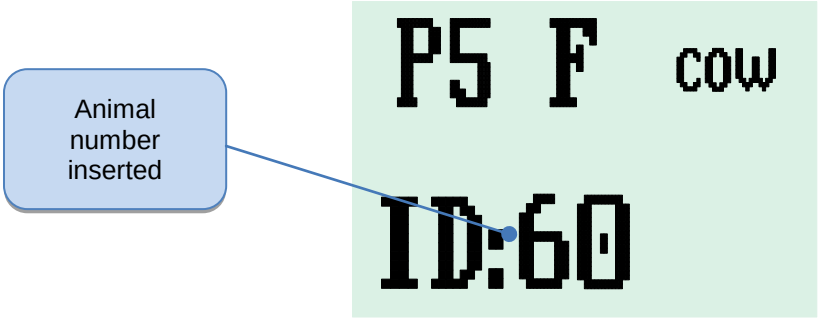
7.2 Milking

Inserting the mobile part of COMBIFAST into the fixed seat, powers the iMilk401 panel. Depending on the parameters set, the panel will start in the WASHING or DETACHMENT phase, or from the last active phase prior to switching off (the latter setting is recommended for milk transport systems. To activate it, set the ***Initial Phase*** parameter to ***Last phase***).

Should the panel be in the WASHING phase on start-up, press the key to stop it and return to detachment. From here, it is possible to start automatic milking by pressing the key or inserting the number of the animal to be milked (with DHM software).

7.2.1 Insert animal ID

From the detachment phase, insert the number of the animal to be milked. Press the key to delete the last digit inserted or to confirm the number input. Press the key to start milking.



7.2.2 Automatic milking with manual detachment

Automatic milking means that milking interruption is controlled by the flow detected from the flow sensor. In this case, the iMilk401 panel determines when stop pulsator, while milker detaches the milking clusters.

NOTE

The *Detachment* parameter must be set on *Manual*

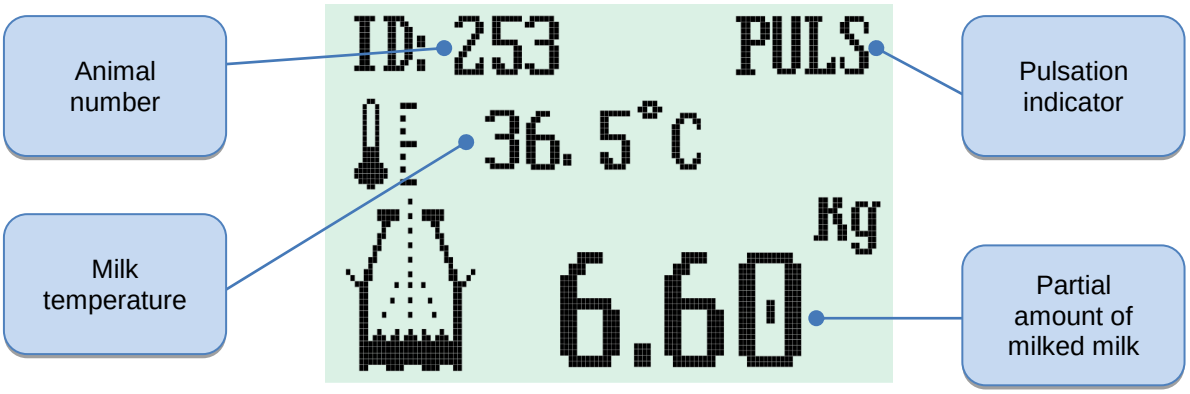
Starting from the detachment by pressing , automatic milking starts and the ***Initial Delay*** count begins, the pulsator is activated and the iMilk401 panel starts counting the milking time.

Once the ***Initial Delay*** has elapsed, the milk flow will be monitored via the sensor.

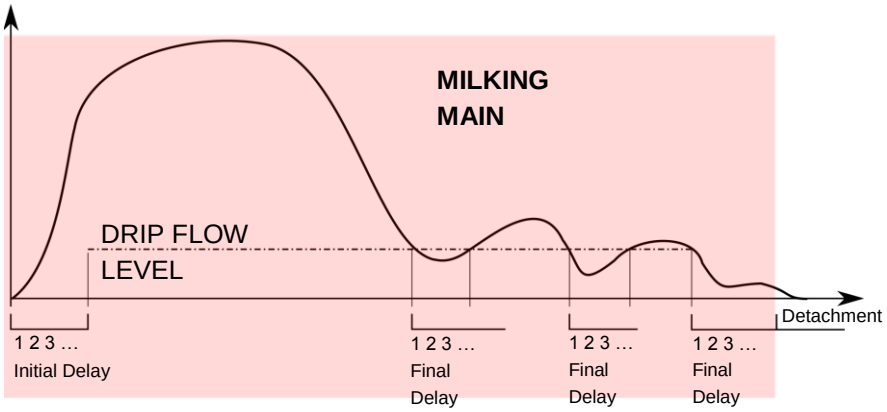
The milking phase usually lasts until the quantity of milk drops below the set threshold in the ***Drip Flow*** parameter, then the ***Final Delay*** starts counting and goes on until the quantity of milk remains below the set threshold.

If you are using the P1 milking program, detachment starts when the ***Final Delay*** has elapsed, the panel starts the antistress pulsation and signals that it is the best time for detachment. By activating the pulsator every 5 seconds, the antistress pulsation allows blood to properly circulate inside the animal's teats without causing injury.

Throughout the entire phase the display shows all the information related to the current milking.



7.2.3 Diagram of automatic milking (program P1)



When milking starts, the pulsation is activated and the milking time count begins

Once **INITIAL DELAY** has elapsed, the main milking starts together with monitoring of the milk

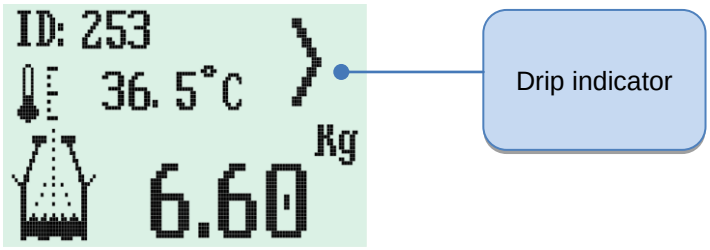
Milking proceeds as usual until the quantity of monitored milk drops below the threshold set in the **MIN FLOW DRIPP.** Then **FINAL DELAY** counting starts

If sufficient milk is detected again for **MIN FLOW DRIPP** before the **FINAL DELAY** has elapsed, milking proceeds as usual

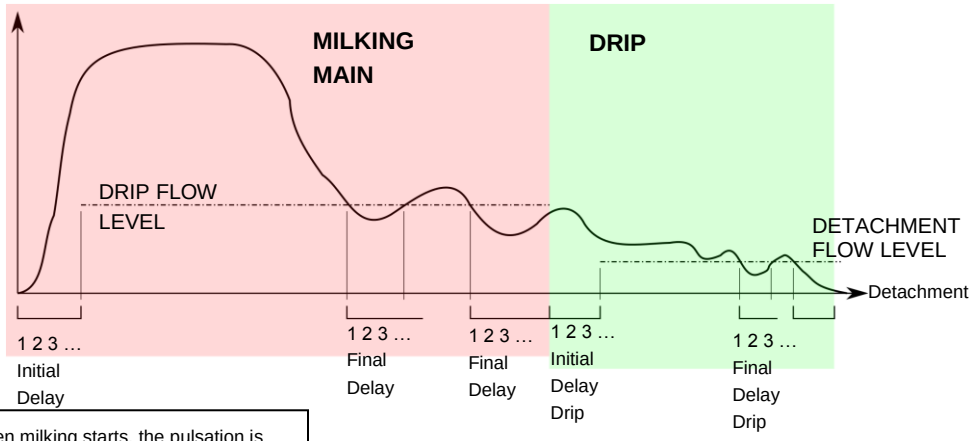
If sufficient milk is NOT detected again from the **DRIP FLOW** before the **FINAL DELAY** has elapsed, detachment operations will start with antistress pulsation

7.2.4 Drip

Using programs P3 – P5 – P7 – P9, if the flow of milk remains below the ***Min Flow Dripp*** until ***Final Delay*** has elapsed, the DRIP phase will start. During this time, you can set different frequency values and milking ratio from the main milking (typically 50:50 per 50ppm). If the flow of milk remains below the threshold set in the ***Min Flow Detach*** parameter for a minimum duration equivalent to the ***Drip Final Delay***, detachments operations will start. An arrow is displayed on the right side of the screen throughout the drip phase.



7.2.5 Automatic drip milking diagram (programs P3 – P5 – P7 – P9)



When milking starts, the pulsation is activated and the milking time count begins

Once **INITIAL DELAY** has elapsed, the main milking starts together with monitoring of the milk

Milking proceeds as usual until the quantity of monitored milk drops below the threshold set in the **MIN FLOW DRIPP.** Then **FINAL DELAY** counting starts

If sufficient milk is detected again for **MIN FLOW DRIPP** before the **FINAL DELAY** has elapsed, milking proceeds as usual

If sufficient milk is **NOT** detected again from the **MIN FLOW DRIPP** before the **FINAL DELAY** has elapsed, it moves on to the DRIP phase

The DRIP phase starts. Once the **DRIPPING INT D** starts, the sensor starts to monitor the milk passing through

Drip operations proceed as usual until the quantity of monitored milk drops below the threshold set in the **MIN FLOW DETACH.** Then **DRIPPING FINAL** counting starts

If sufficient milk is detected again for **DETACHMENT FLOW** before the **DRIP FINAL DELAY** has elapsed, drip operations proceed as usual

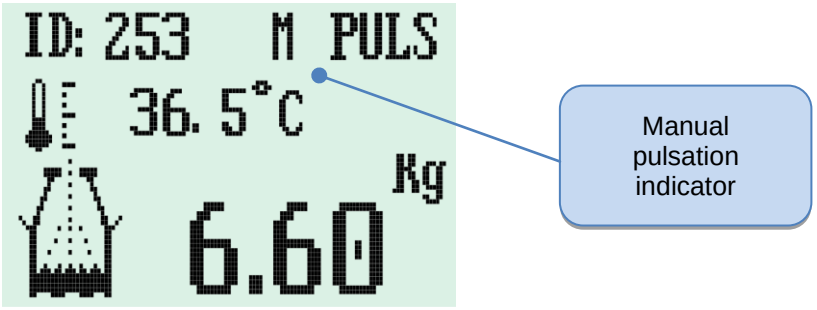
If sufficient milk is NOT detected again from the **DETACHMENT FLOW** before the **DRIP FINAL DELAY** has elapsed, detachment operations will start with antistress pulsation

7.2.6 Manual Milking

Manual milking is when milking continues until the milker decides to interrupt pulsation by pressing , and detaching the milking clusters. In this case, the ideal time to detach is at the milker's discretion.

NOTE
The panel does not in any way indicate the most suitable time for detachment and pulsation continues normally until the operator intervenes or until the MAX MILKING TIME lapses.

From detachment, pressing starts the automatic milking, activates the pulsator and the iMilk401 panel starts counting the milking time. Pressing the key now moves on to manual milking.



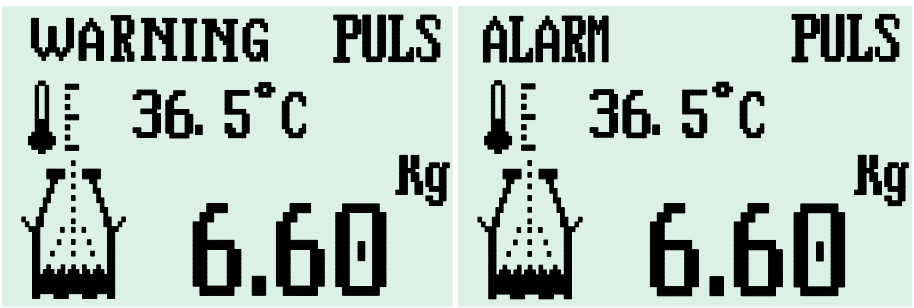
On completion of milking, the milker determines when to detach the clusters from the animal. Press for the panel to stop pulsation.

7.3 Alarms

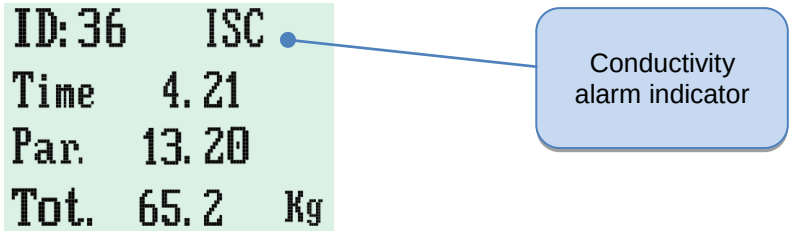
7.3.1 Conductivity alarm

If the control is activated (***Conduct Control*** parameter) in the event that conductivity of milk surpasses the threshold set in the ***Conductivity Thresh***, the display will show the wording “WARNING”. If conductivity remains above the set level, the display will show “ALARM”.

NOTE
The conductivity alarm indicates that the milk produced by the animal may have problems, which is usually linked to the onset mastitis A medical examination is anyhow essential to diagnose the onset. The conductivity alarm only focuses attention on possible anomalies encountered during milking and is not a diagnosis instrument in itself.



On completion of milking in which a conductivity alarm was encountered, the summary screen will display ISC information



7.3.2 Temperature alarm

If the temperature control is activated (***Temper.Control*** parameter) and its value exceeds the value set in ***Edge Alarm Temp*** during milking, the thermometer on the display will start flashing to signal the problem.

NOTE

The temperature alarm indicates that the animal may have problems. A medical examination is anyhow essential to diagnose any possible disease. The temperature alarm only focuses attention on possible anomalies encountered during milking and is not a diagnosis instrument in itself.

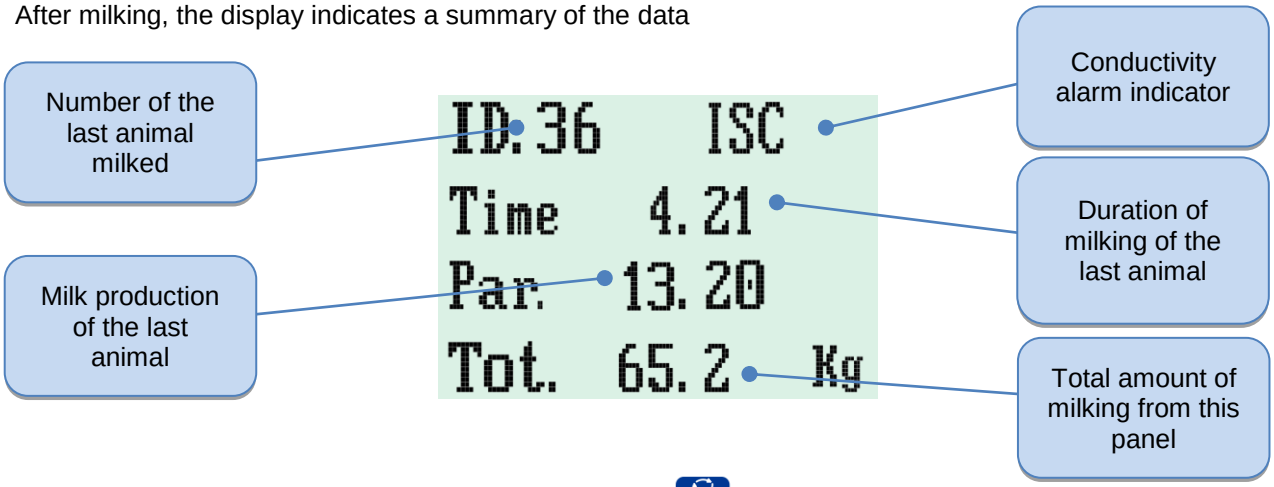
7.4 Detachment procedure

Once milking has elapsed, the antistress function is activated, meaning the pulsator is activated every 7 seconds to allow the blood to circulate the animal's teats.

CAUTION

The milker is responsible for the manual detachment of the milking clusters by acting on the claw valve.

Detachment operations are started at any time during milking by pressing the key,
After milking, the display indicates a summary of the data



After viewing the summary of the last milking, press the key to go back to stand-by.

7.5 Stimulation

7.5.1 Manual

MANUAL stimulation can be activated from any program (P1 – P3 – P5 – P7 – P9) and at any time during milking.

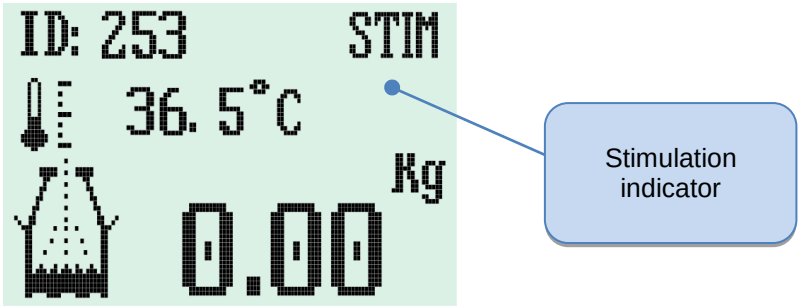
By pressing the key, the pulsator promptly gradually changes the frequency and milking ratio until reaching the value set in the parameters

- ***Stimulation PR***
- ***Stimo Ratio REAR***
- ***Stimo Ratio FRONT***

After the time set in the ***Stimulation Time*** parameter, stimulation is stopped and the panel returns to normal milking conditions

During this phase the display indicates the wording STIM as a milking indicator.

It is possible to activate stimulation many times during the same milking process.



7.5.2 Forced

Stimulation at the beginning of milking is an active phase only in program P9.

Since it is a forced stimulation, you are only required to set P9 as the milking program to activate it.

At the beginning of milking, the panel will always carry out stimulation by following the parameters set for manual stimulation

- ***Stimulation time***
- ***Stimulation PR***
- ***Stimo Ratio REAR***
- ***Stimo Ratio FRONT***

7.6 Washing

To go into WASHING mode, press keys  and  simultaneously to start the washing phase from detachment. The display will monitor and display the washing water temperature.

CAUTION
For proper maintenance of the flow sensor, it is recommended to carry out at least 2 acid washes a week with hot water (at least 60°C – 140°F). Failure to comply with this warning may cause system reading errors.

If provided, data download onto the PC by means of the DHM software occurs during the washing phase. The following screen appears on the panel that is currently downloading data, which shows the advance process.

CAUTION
During data download:
- **Do NOT operate any panel keys.**
- **Do NOT remove Combifast from the panel in question.**
- **Do NOT insert or remove other Combifast on the washing station.**

You are advised to connect all Combifast in their proper washing stations with the fixed parts NOT powered. Once all panels are connected, power the fixed stations to start data download.

8 PROGRAMMING

The Portable iMilk401 Lite can set up to 5 programs (P1 – P3 – P5 – P7 – P9); each one can be customised with different parameters and features.

	P1	P3	P5	P7	P9
MILKING	Present	Present	Present	Present	Present
LEVEL	X	Present	Present	Present	Present
STIMULATION	X	X	X	X	Present

Programs P3, P5 and P7 differ on account of their different general parameter settings. For details, refer to the following paragraph, which has a complete list of programming parameters.

During the detachment phase, the display indicates the program currently being used in the top left corner, and you can press the  key to go to the next program (in order to do so, the ***Lock Programs*** parameter must be deactivated).

8.1 General parameters

	Parameter	Description	Default	Values
1	CONTRAST	Enables you to choose the LCD display contrast	5	0 ÷ 10
2	CAN-ID	Only used with the DHM software, it identifies the panel	1	0 ÷ 127
3	Language	Select the software language (English - Italian – French - Russian)	English	English, French Italian, Russian
4	DC Power	Not used for the Portable iMilk401 Lite application	DC	DO NOT CHANGE
5	Lock Programs	If it is active, avoid erroneously changing the milking program. Set to "NO" if you require different set parameters for various animals, and change the program used between one animal and another.	Yes	Yes - No
6	Initial phase	Enables you to choose the panel starting phase	Last phase	Last phase Washing Milking
7	Unit type	Set to °C/Kg or °F/lb.	°C/Kg	°C/Kg °F/lb
8	Enable autost	Not used for the Portable iMilk401 Lite application	No	DO NOT CHANGE
9	S-G	Not used for the Portable iMilk401 Lite application	Cows	DO NOT CHANGE
10	Detachment	Not used for the Portable iMilk401 Lite application	Manual	DO NOT CHANGE
11	Milk meter calib	In order to have a more precise measurement, it enables you to modify calculation of the quantity milked. Refer to chapter 9 *- CALIBRATION*	12	0 ÷ 30
12	MIn Flow Dripp	Set the minimum milk quantity to move on to the DRIP phase	0.6	0.01 ÷ 2.00 l/min
13	Min Flow Detach	Set the minimum milk quantity to move on to the DETACHMENT phase	0.2	0.01 ÷ 2.00 l/min
14	Re Attach Time	After detachment of the clusters and if second milking starts before this delay elapses, the milked milk will be added to that of the previous animal.	1	1 ÷ 600 s
15	Temper. Control	Choose when to enable the temperature control.	All	All Only Wash No
16	Temper. Calibr	It enables you to calibrate the temperature reading of the probe. Refer to chapter 9.3 *- Temperature calibration*	10.00	0.00 ÷ 20.00
17	Edge Alarm Temp	If the milk temperature rises above this threshold, the panel issues an alarm	39.5	35.0 ÷ 45.0°C
18	Conduct Control	Enable conductivity control	Yes	Yes - No
19	Conduct Thresh	It indicates sensitivity in the conductivity reading. Decrease the said value if there are too many alarms.	40	0 ÷ 60
20	Conduct Delay	Set the initial quantity of milk for which conductivity is not initially controlled.	3	1 ÷ 20
21	Max Milking Time	Once this time has elapsed, the panel removes the milking clusters.	15	0 ÷ 180 min

22	Max Wash time	This time starts counting at the beginning of the washing phase. The panel switches off at the end	120	0 ÷ 250 min

8.2 Customised programs

iMilk401 enables you to customise 5 milking programs, each one can be set with different parameter sets.

		Parameter	Description	Default					Unit	Max/min
				P1	P3	P5	P7	P9		
STIMULATION	23	Stimulation Time	It enables you to set the stimulation duration	//	//	//	//	15	Seconds	0 / 250
	24	Stimulation PR	It enables you to set the frequency during stimulation	//	//	//	//	120	Puls/min	50/180
	25	Stimo Ratio REAR	It enables you to set the REAR pulsation ratio during stimulation	//	//	//	//	30/70	Ratio	25/75
	26	Stimo Ratio F.	It enables you to set the FRONT pulsation ratio during stimulation	//	//	//	//	30/70	Ratio	25 / 75
MAIN MILKING	27	Initial Delay	It enables you to set how much time to wait to start monitoring the quantity of milk	90	90	90	90	75	Seconds	0/255
	28	Milking PR	It enables you to set the frequency during milking	60	60	60	60	60	Puls/min	50 / 180
	29	Milking ratio R	It enables you to set the REAR pulsation ratio during milking	60/40	60/40	65/35	65/35	60/40	Ratio	25 / 75
	30	Milking ratio F	It enables you to set the FRONT pulsation ratio during milking	60/40	60/40	65/35	60/40	60/40	Ratio	25 / 75
	31	Final Delay	If no continuous flow of milk is detected after the delay has elapsed, it will move on to the DRIP phase or detachment operations will start (only for P1)	9	9	9	9	9	Seconds	0 / 255
LEVEL	32	Dripping Int D.	It enables you to set how long to wait to start monitoring the quantity of milk for the DRIP phase	//	15	15	15	15	Seconds	0 / 255
	33	Dripping PR	It enables you to set the frequency during the DRIP phase	//	50	50	50	50	Puls/min	50 / 180
	34	Dripping Ratio F	It enables you to set the REAR pulsation ratio during the DRIP phase	//	50/50	50/50	50/50	50/50	Ratio	25 / 75

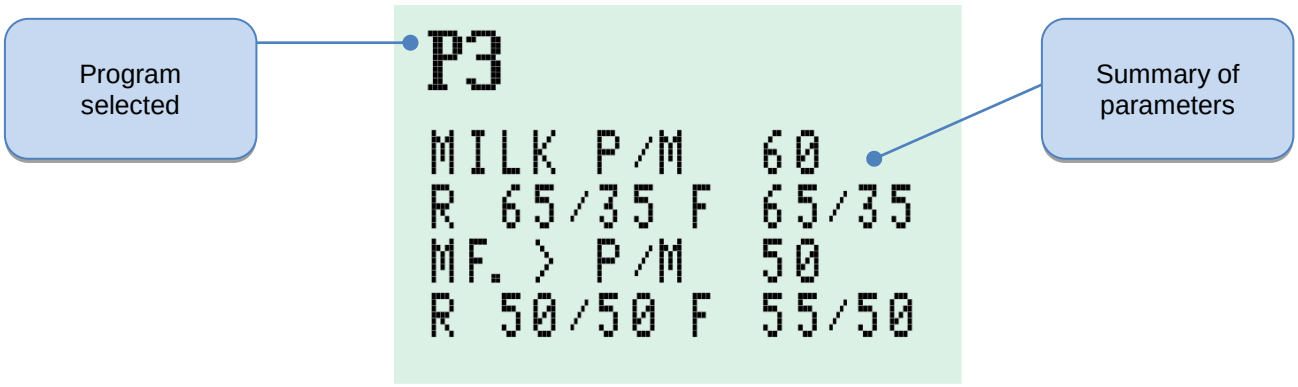
	35	Dripping Ratio R	It enables you to set the FRONT pulsation ratio during the DRIP phase	//	50/50	50/50	50/50	50/50	Ratio	25 / 75
	36	Dripping Final	If no continuous milk flow is detected after the delay has elapsed, detachment operations will start	//	8	8	8	8	Seconds	0 / 255
	37	Vacuum Delay	Not used for the Portable iMilk401 Lite application	//	//	//	//	//	Seconds	DO NOT CHANGE
DETACHMENT	38	Detachment Delay	Not used for the Portable iMilk401 Lite application	//	//	//	//	//	Seconds	DO NOT CHANGE
SUCTION	39	Sweep Delay	Not used for the Portable iMilk401 Lite application	//	//	//	//	//	Seconds	DO NOT CHANGE
	40	Sweep Length	Not used for the Portable iMilk401 Lite application	//	//	//	//	//	Seconds	DO NOT CHANGE

8.3 Change parameters

NOTE

In addition to the parameters of all common programs, the parameters only of the actual program selected will be displayed on entering the menu.

To access the programming mode, first press the key; a summary will be displayed of the set parameters.



Simultaneously press the and keys to access the list of parameters, with the possibility to change them. You can scroll through the parameters by means of the and buttons. Press to access the change mode: set the desired value with the and keys.

Then press to confirm or not to change the parameter and return to list.

To exit the programming menu, select the EXIT parameter or press the key.
Disconnect power supply from the panel, disconnecting Combifast to save the changed parameters.

9 CALIBRATION

9.1 1st level milk calibration measurement (on each panel)

The ***Milk Meter Calib*** parameter is used to calibrate measurement of each system Portable iMilk401 Lite. Each stable requires a different setting due to the different vacuum level, tube length, air input and milk ascent/rising.

Before calibrating, you need to check:

- That the milk tube installed has an internal diameter of Ø16mm, not less or more
- That the air inlet holes on the claw are totally unobstructed
- That the tubes have been properly inserted (refer to 6.2 *- Pneumatic Connections*)
- That the Portable iMilk401 Lite is properly positioned during milking (refer to 6.5 *- Positioning of the Portable iMilk401 Lite during milking*)

CAUTION

If the aforesaid checks prove to be incorrect, the Portable iMilk401 Lite does not guarantee the declared measurement precision.

CAUTION

It is recommended to calibrate measurement after at least 1 week of milking so that the system adjusts itself.

To calibrate, disconnect the milk tube that runs from the Combifast to the sensor and place a bucket as shown in the figure.

- Milk the first animal, and after milking, weigh the actual quantity of milk in the bucket.
- Calculate the difference with regard to what was measured by the Portable iMilk401 Lite.
- Repeat the operations for a total of three animals.
- Calculate the measurement error as an average of the three differences.
- Then change the ***Milk Meter Calib*** parameter as follows:
  - Each parameter dot corresponds to approximately 0.35Kg (±10%)
  - If the panel measurement is higher than the actual value, decrease the parameter value
  - If the panel measurement is lower than the actual value, increase the parameter value

EXAMPLE

MILKING	iMILK401 VALUE	ACTUAL VALUE	DIFFERENCE	AVERAGE
1	11.6 Kg	13.7 Kg	- 2.1 Kg	- 1.26 Kg
2	6.8 Kg	7.1 Kg	- 0.3 Kg	
3	10.9 Kg	12.3 Kg	- 1.4 Kg	

Undervalued panel.
You need to INCREASE the ***Calibration Sensor*** parameter by 4 dots.

$$\frac{1.26}{0.35} = 3.6 \approx 4$$

NOTE

In a limited way, the measurement of the quantity of milk milked depends on the parameter of conductivity. Should the conductivity parameter be changed by various dots, it may be necessary to calibrate the system once again.

NOTE

Each dot of the "*MILK METER CALIB*" parameter corresponds to approximately 0.35kg. This is an average value of the actual value, which depends on the flow, conductivity and duration of milking.

9.2 2nd level milk calibration measurement (on the total milked)

Instead of calibrating each panel, it is also possible to calibrate the total amount milked during the milking session. Therefore, you need to compare the actual total from the tank with the value of each Portable iMilk401 Lite. This value can be obtained in two ways:

1. If you have the DHM software, you simply have to go to Menu >> Report and select Monthly Production. This way, it will display production for the month selected, divided into morning and evening milking.
2. Alternatively, add up the amount of milk of each Portable iMilk401 Lite after milking.

NOTE

In this second case, before milking, you are required to set the data of the previous milking to zero, keeping the key pressed on each Portable iMilk401 Lite.

Once the actual data and those of the Portable iMilk401 Lite have been obtained, work out the difference of the two values and divide it by the number of animals milked.

The value obtained will be the average error of each animal. To calibrate, change the ***Milk Meter Calib*** parameter as follows:

- Each dot corresponds to approximately 0.35Kg (±10%)
- If the panel measurement is higher than the actual value, decrease the parameter value
- If the panel measurement is lower than the actual value, increase the parameter value

EXAMPLE

TOTAL iMilk401	TOTAL TANK	DIFFERENCE
1321 Kg	1150 Kg	+ 171 Kg

Overvalued panels.

Let's hypothesize that you have milked 100 animals, the average error per animal will be:

$$\frac{171}{100} = 1.71$$

Each panel OVERVALUES by 1.71Kg per animal

You need to DECREASE the ***Milk Meter Calib*** parameter by 5 dots.

$$\frac{1.71}{0.35} = 4.88 \approx 5$$

9.3 Temperature calibration

For perfect calibration, compare the level indicated by the panel with the value read by a thermometer. Then increase (or decrease) the ***Temper Calib*** parameter value by the amount of dots that iMilk401 undervalues (or overvalues)

EXAMPLE

If the iMilk401 panel reads a value of 37.5°C and the thermometer reads 36.4°C, decrease the ***Temper Calib*** parameter by 1.1

$$37.5 - 36.4 = 1.1$$

10 GENERAL MAINTENANCE

WARNING

Do not carry out any maintenance if the Portable iMilk401 Lite is connected to the mains. Before performing any maintenance to the Portable iMilk401 Lite, disconnect the machine from the mains.

The only daily maintenance that must be performed with the device connected to the mains is washing the milking system.

WARNING

Perform maintenance of the Portable iMilk401 Lite positioning it on a solid base (table) and perform maintenance with the Portable iMilk401 Lite in a milking or washing position.

10.1 Component maintenance

10.1.1 LE30 pulsator

- It is recommended to clean the filter cartridge every 6 months for correct pulsator operation. Proceed as follows:
  - Remove the filter and rinse it with clean water and liquid soap (e.g. dishwashing detergent - ref. fig. 1).

CAUTION

In very humid and dusty environments, cleaning should be performed every 3 months.

WARNING

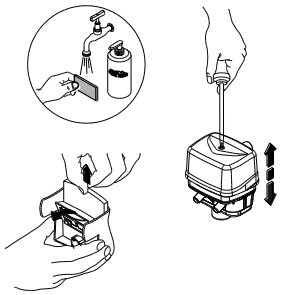
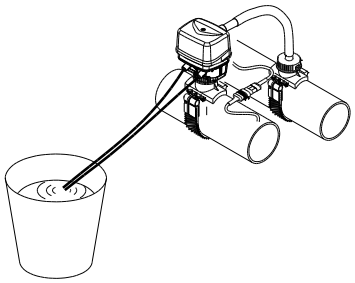
It is forbidden to lubricate the filter with oil

- If water goes into the pulsator (e.g. due to breakage of a liner), cleaning must be carried out immediately.
  - Wash the pulsator (see Figure 2) only with lukewarm water, disconnecting the filter cartridge or filtered air piping. Alternate 5 seconds of water intake and 5 seconds of air intake; if water starts coming out of the hood, allow only air intake to prevent the water from affecting the electrical part. Therefore, leave the pulsator operating for approximately 30 minutes to eliminate excess water.

CAUTION

It is recommended not to wash the pulsator more than once every 6 months, except in case of sheath breakage.

- Once a year, check the frequency and the pulsation ratio. Request the intervention of specialised personnel.
- After 5000 hours of operation at 60 ppm, it is necessary to carry out a general review of the pulsator. Request intervention of your dealer.

Fig. 1 - Filter cleaning	Fig. 2 - Pulsator washing
	

10.2 Periodic maintenance

10.2.1 Daily

It is essential to adequately wash the milk tubes in order to remove bacteria left in the line and equipment after each milking. The said bacteria can contaminate the milk, damage the equipment and cause detachment of the clusters, resulting in incorrect reading of the milk flow.
After each milking session, wash the milking unit and each surface of the milking system machine in contact with the milk, as follows:

1. Fasten the sheaths to the washing jets or put the milking unit in the washing tank
2. Put each iMilk401 panel into washing mode
3. Start rinsing and proceed with washing using temperature between 60°C ÷ 90°C (140°F ÷ 194°F) for the main washing.
4. Before the next milking, sanitize surfaces in contact with the milk according to normal washing instructions
5. After washing, set each Portable iMilk401 Lite in milking mode again.

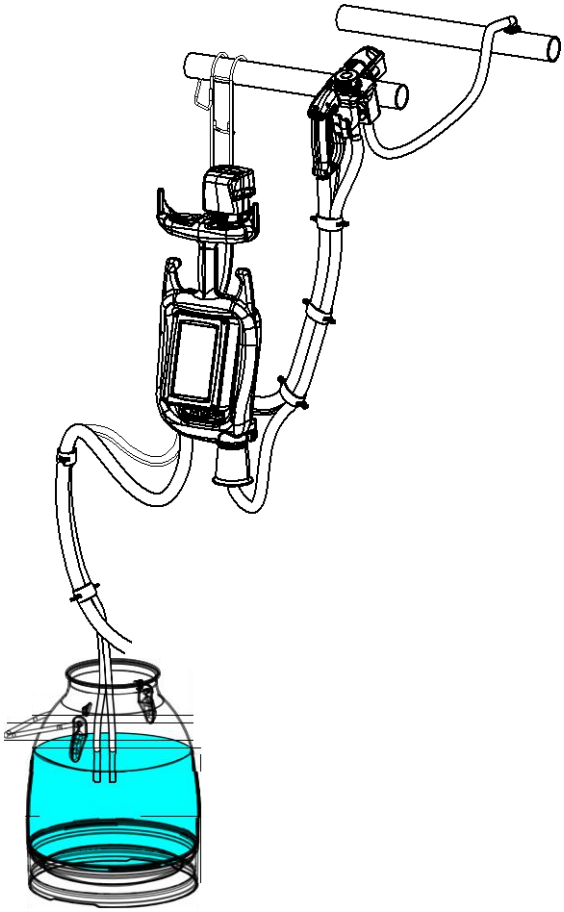
10.2.2 Weekly

Three times a week, wash with a solution of water + nitric or phosphonitric acid, in concentrations NOT exceeding 3%, or according to the instructions of the product's manufacturer.

10.3 Extraordinary maintenance

In the event that, following the breakage of a liner, milk goes directly into the tank and pulsator, proceed as follows:

- Suspend milking and replace the damaged sheath.
- After replacing the broken liner, wash the Portable iMilk401 Lite with warm water only, disconnecting the pulsator's filter cartridge and sucking up the warm water from the pulsator twin tube. Alternate between 5 seconds of water suction and 5 seconds of air. If water starts coming out of the pulsator hood, suck up air only to prevent water from getting into contact with electrical parts.
- Therefore, leave the pulsator operating for approximately 10 minutes to eliminate excess water and dry the device.



CAUTION

After the device has been washed it is recommended to drain the washing water from the vacuum pipeline.

11 TROUBLESHOOTING

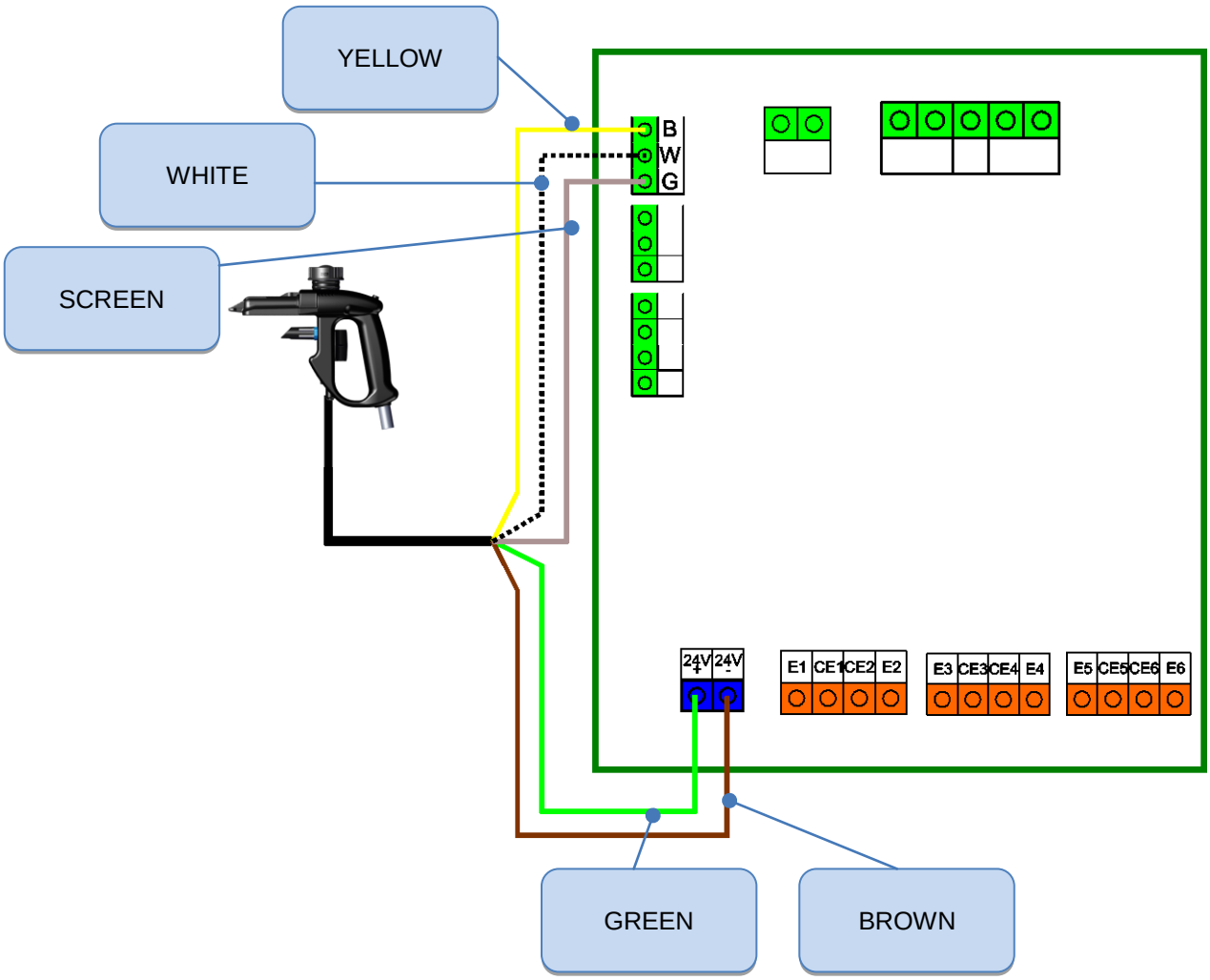
PROBLEM DETECTED	POSSIBLE CAUSE	SOLUTION
Milk enters the Portable iMilk401 Lite tank	Sheath breakage	Replace the damaged sheath. Wash the tank following the procedure contained in chapter 10.3 *- Extraordinary maintenance*
The sensor overvalues or undervalues the quantity of milked milk	1 - Foreign bodies inside the sensor	Check that there are no foreign bodies, such as straw, inside the sensor
	2 - Milking panel power supply outside the range of 24VDC -5%/+20%	Check that the power supply range falls within the one indicated in the specifications
	3 - Wrong calibration parameter	If after checking the previous points, the panel still does not read correctly, calibrate the panel as per procedure contained in Chap. 9 *- CALIBRATION*
The panel does not read the passage of milk	1 - The sensor is not properly connected	Open the iMilk401 panel and check that the sensor is connected as illustrated in the diagram **Errore. L'origine riferimento non è stata trovata.** - **Errore. L'origine riferimento non è stata rovata.Errore. L'origine riferimento non è stata trovata.**
	2 - the claw opening is obstructed	Open the claw opening (diameter 0.8 mm)
Milk remains in the animal's udder	Parameters not set correctly	It is possible to: - Increase the ***Final delay***/***Dripping Final*** parameter - Decrease the ***Min Flow Dripp***/***Min Flow Detach*** parameter
The animal goes into overmilking	Parameters not set correctly	It is possible to: - Decrease the ***Final delay***/***Dripping Final*** parameter - Increase the ***Min Flow Dripp***/***Min Flow Detach*** parameter

12 DHM SOFTWARE

12.1 Installation and initial use

12.1.1 Combifast mobile part electrical connections

Should the DHM software be available and data transfer is required, the cable coming from the Combifast pistol will be shielded by 4-pole. In this case, connect the conductors as indicated in the following image.

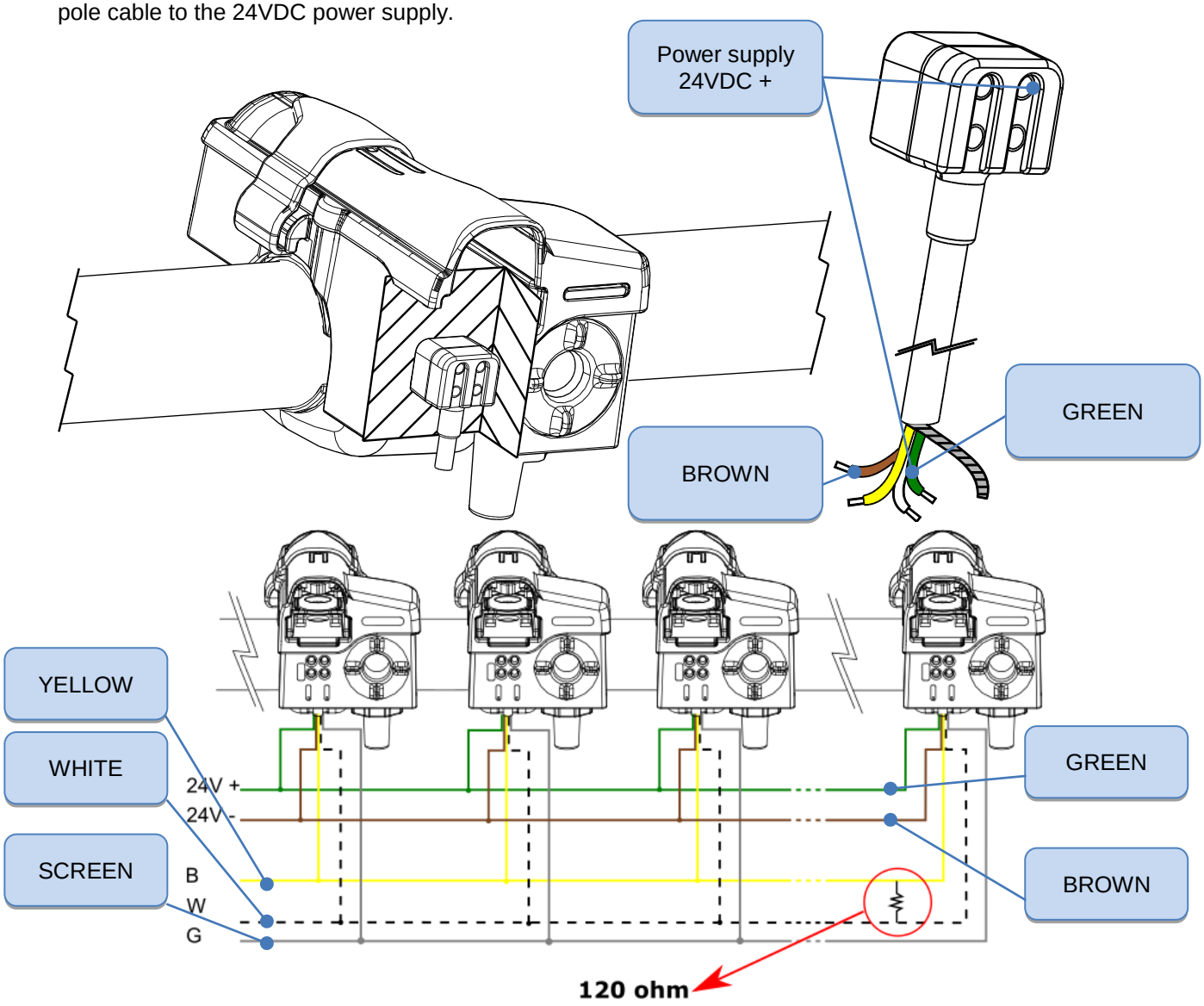


	Terminal	Description	Cable Colour
POWER SUPPLY	+24VDC	SUPP.	GREEN
	-24VDC	SUPP.	BROWN
SUPPLY	B	DATA DOWNLOAD	YELLOW
	W	DATA DOWNLOAD	WHITE
	G	DATA DOWNLOAD	SCREEN

12.1.2 Combifast fixed washing part electrical connections

During washing, a fixed part should be prepared for each Portable iMilk401 Lite to enable washing of each milking cluster. When washing each Portable iMilk401 Lite (if provided), download the milking data to the DHM software.

Should data download not be required, all you need to do is connect the BLUE and BLACK cables of the 2-pole cable to the 24VDC power supply.



WARNING

Insert a 120 Ohm resistor between the yellow cable and the white cable of the last washing station

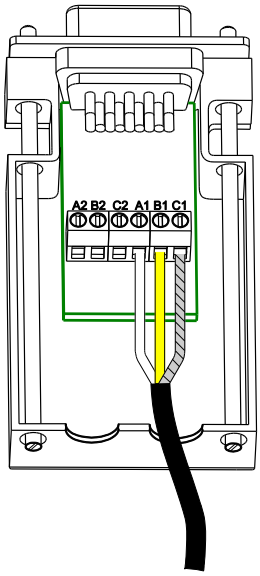
	Terminal	Description	Cable Colour
POWER SUPPLY	+24VDC	SUPP.	GREEN
	-24VDC	SUPP.	BROWN
SUPPLY	B	DATA DOWNLOAD	YELLOW
	W	DATA DOWNLOAD	WHITE
	G	DATA DOWNLOAD	SCREEN

NOTE

You are not required to connect the cables dedicated to the CAN BUS line in the fixed part of the Combifast installed in the milking shed.

12.1.3 Connector

Remove the two screws from the collector and separate the two half-shells. Connect the CAN BUS poles as illustrated in the following figure and close the connector.



	Description	Cable Colour
SUPPLY	A1	WHITE
	B1	YELLOW
	C1	SCREEN

12.1.4 iMilk401 parameters settings

For the data download network to operate correctly, you are to allocate an identification number to each Portable iMilk401 Lite, following the procedure hereunder:

- From the detachment phase, press the key to display the milking parameters summary
- Then simultaneously press the + and - keys to access the programming mode
- Repeatedly press the + key until reaching the **CAN-ID** parameter
- Press the key to display the current value of the **CAN-ID** parameter
- Press the + or - keys to set the desired value
- Press the key to confirm the new parameter value
- Press the key to exit the programming mode
- Disconnect power supply to save the changed parameters

NOTE

Each iMilk401 can be identified by a number between 1 ÷ 127.

Each iMilk401 must have a DIFFERENT identification number from all the other Portble iMilk401 used

12.1.5 Software installation

CAUTION
Do NOT connect the CAN converter before the software is properly installed.

Insert the USB key into the PC and launch the file inside it. Follow the instructions until the software is completely installed and the DHM icon appears on the desktop.

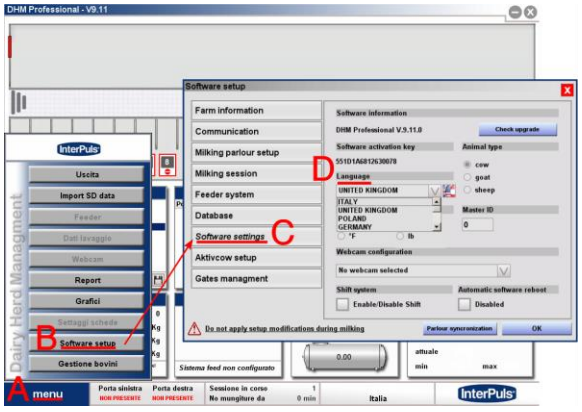
Then connect the connector to the USB-to-CAN and connect the latter to the PC, which will thus install the new hardware that will be automatically detected.

Once the software is launched, you will be asked to register. Insert the farm data and KEY ACCESS reported on the sheet attached to the software.

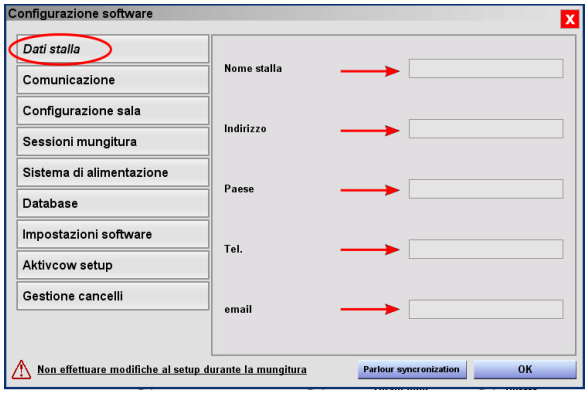
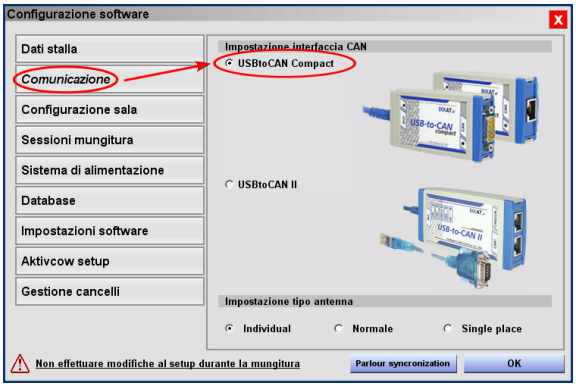
12.1.6 Software settings

On first start-up of the software, you must set the farm's personal data in which DHM is installed.

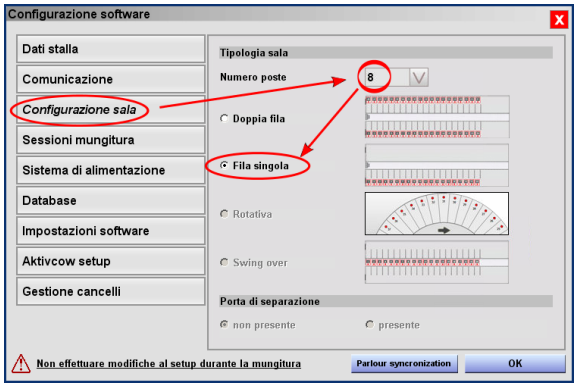
Launch the DHM software, select the **MENU (A)** button at the bottom left corner and then select **SOFTWARE SETUP(B)**. First select the **SOFTWARE SETTINGS (C)** item and then the desired language **LANGUAGE (D).** Confirm and close the software to enable the change of language



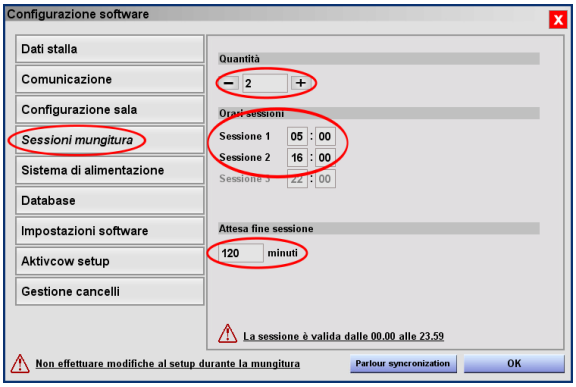
Scroll through the following sub-menus and set the desired parameters one at a time:

STABLE DATA: insert the farm's data	**COMMUNICATION**: select the first item **USBtoCAN Compact** as the communication interface
	

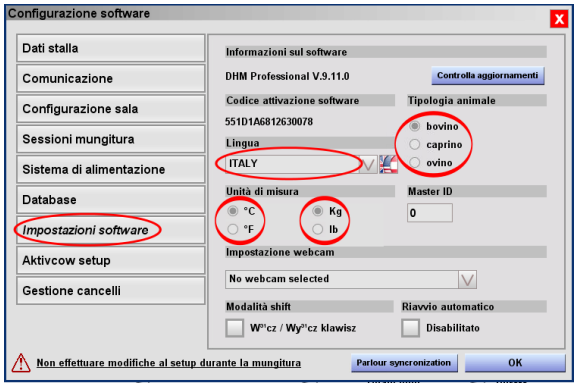
STABLE CONFIGURATION: select the Portable iMilk401 Lite number and **Single row** as the type of stable



MILKING SESSION: set the number of milking carried out daily, the start times and duration of the data download



SOFTWARE SETTINGS Select the language, the type of animal and the unit of measure desired



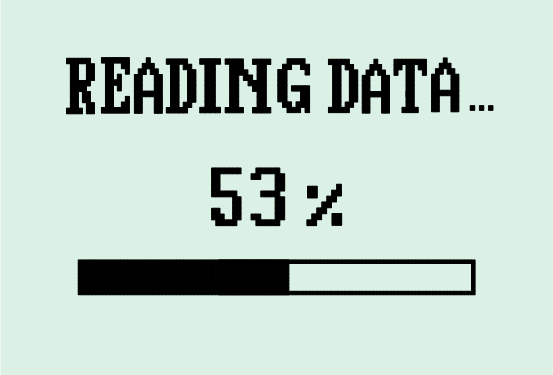
NOTE

Set the milking times, inserting them at least 1 hour prior to actual start times

Then press **OK** to confirm, close the software and open it again to effect the changes.
The DHM software now shows a representation of the stable in the upper part with the correct number of panels inserted.

12.2 Data Download

After connecting Combifast of all panels to the fixed part connected to the CAN network, and after supplying the stations, the iMilk401 will start downloading data in sequence to the DHM software. The panel currently downloading the data displays the progress.



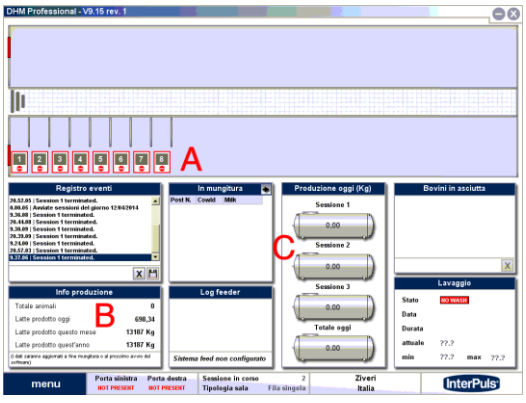
CAUTION
You are advised to connect all Combifast in their proper washing stations WITHOUT supplying the fixed parts of Combifast. Once all panels are connected, supply the fixed stations and start downloading data and washing of the Portable iMilk401 Lite

WARNING
During data download

- **Do NOT operate any panel keys.**
- **Do NOT remove Combifast**
- **Do NOT insert or remove other Combifast**
- **Do NOT disconnect power supply**
- **Do NOT switch off the PC**
- **Do NOT close the DHM software**

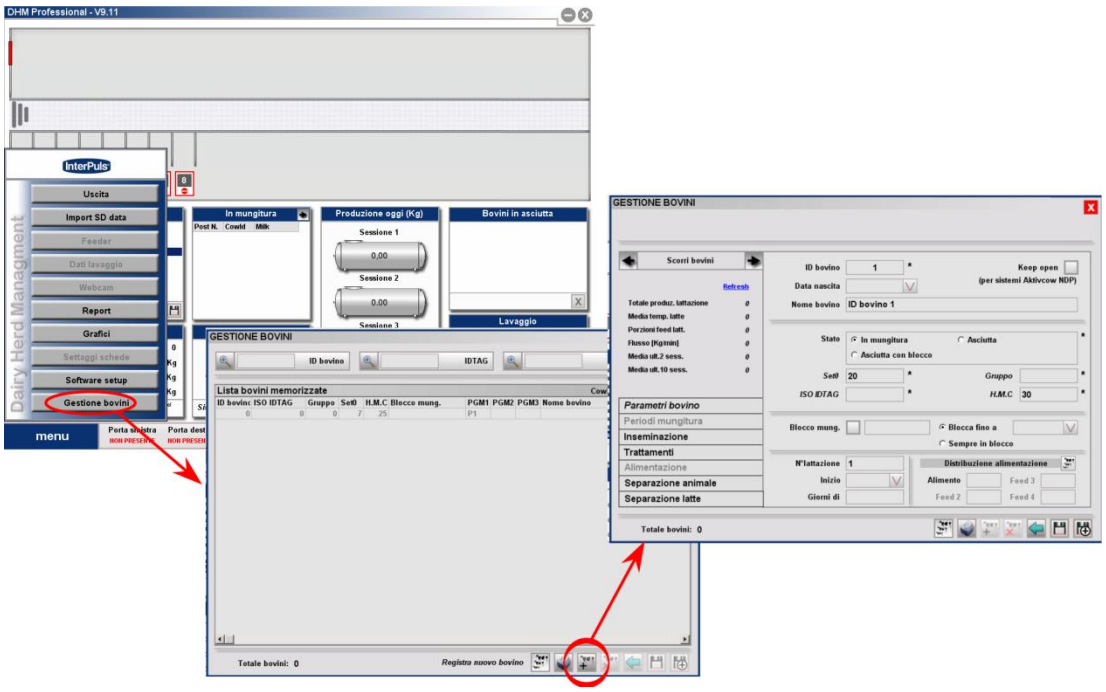
12.3 Software operation

12.3.1 Initial screen



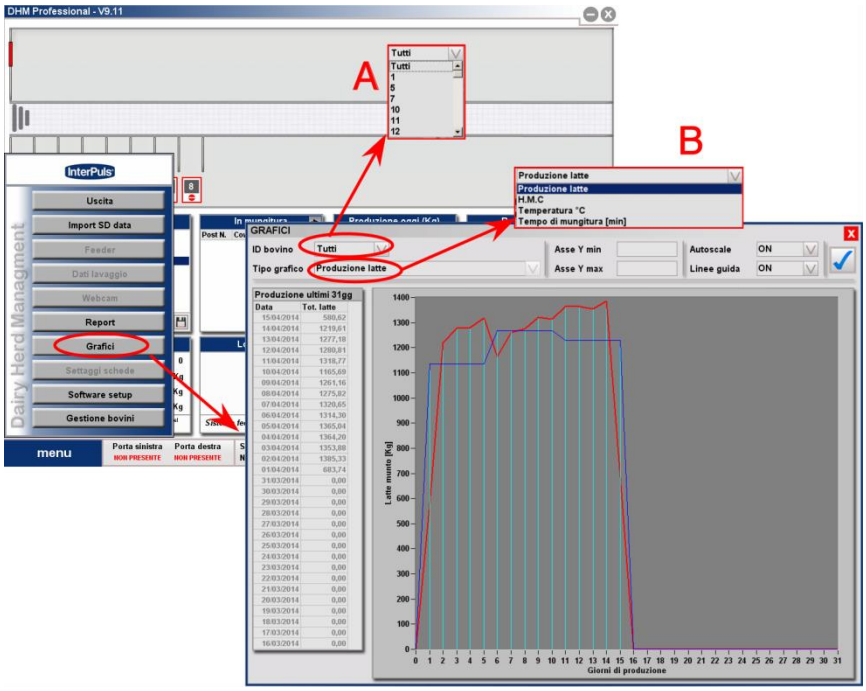
A. Shed configuration
B. Daily/monthly/annual production summary
C. Morning production summary/

12.3.2 Cow management screen



From the main menu, select **Cow Management** and then the third icon to manage the animals of your farm. From the screen that appears, you can insert all data relating to the various animals.

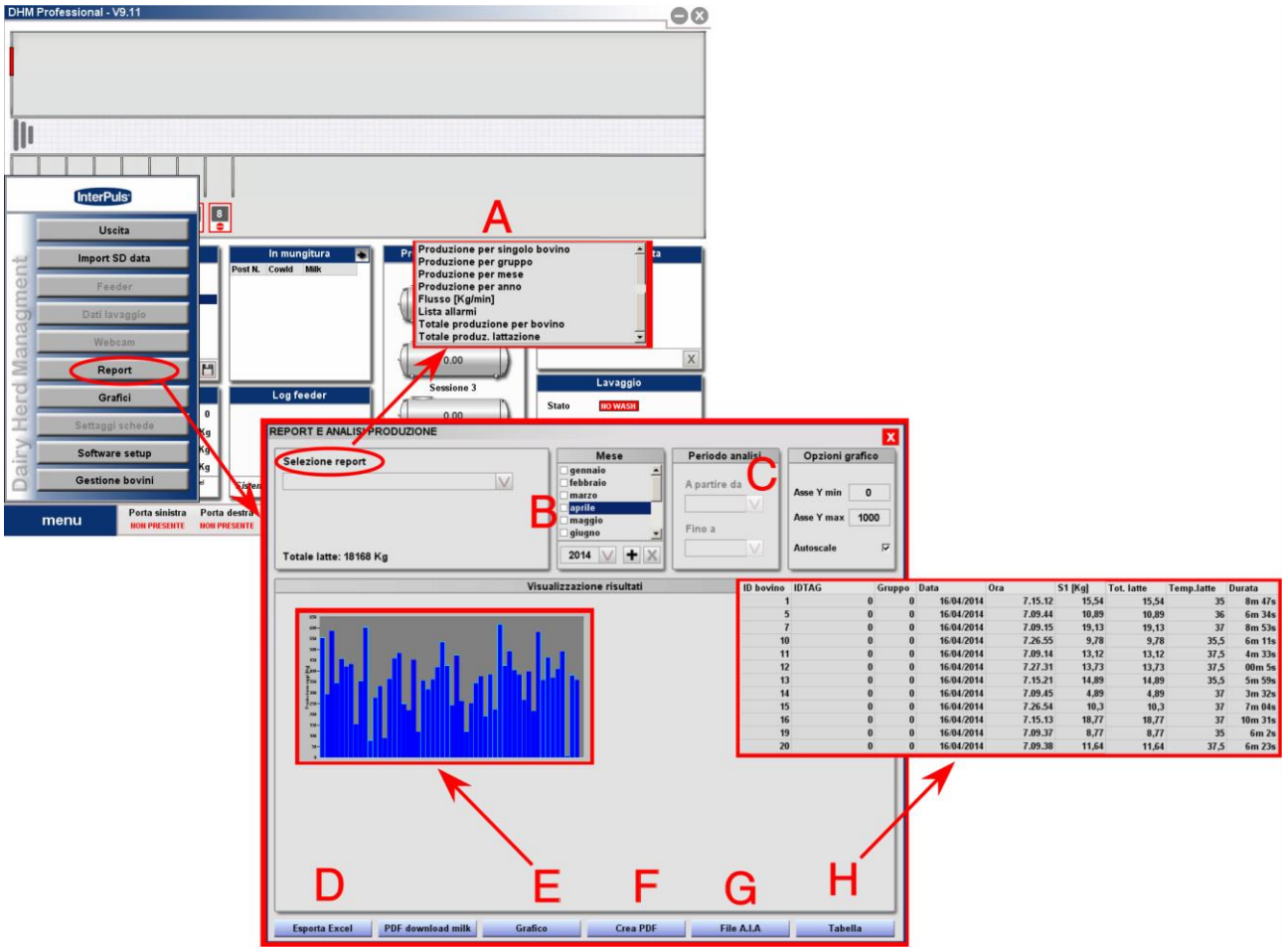
12.3.3 Graphs screen



Selecting the item **Graphs** from the main menu, it is possible to create graphs regarding each animal or a whole herd (A) reporting different information (B), such as:

- Milk production
- Conductivity (H.M.C.)
- Temperature
- Milking time (in minutes)

12.3.4 Report screen



From the main menu, selecting the item **Report**, it is possible to create summary tables and files, as follows:

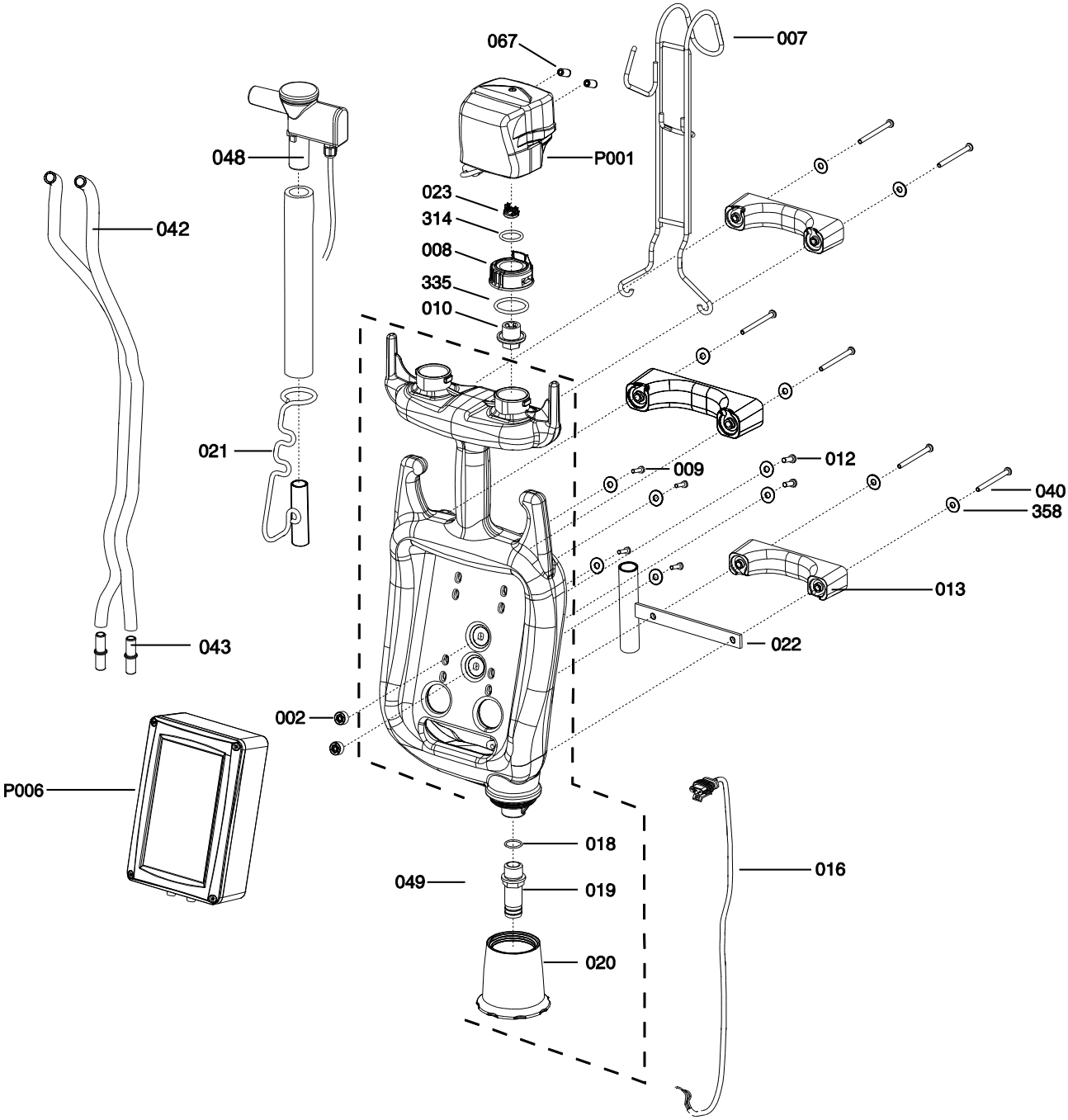
A. Select the type of report desired
B. Select the options related to the report (for example, which animal to display)
C. Select the period of time to display

It is now possible to create different types of output:

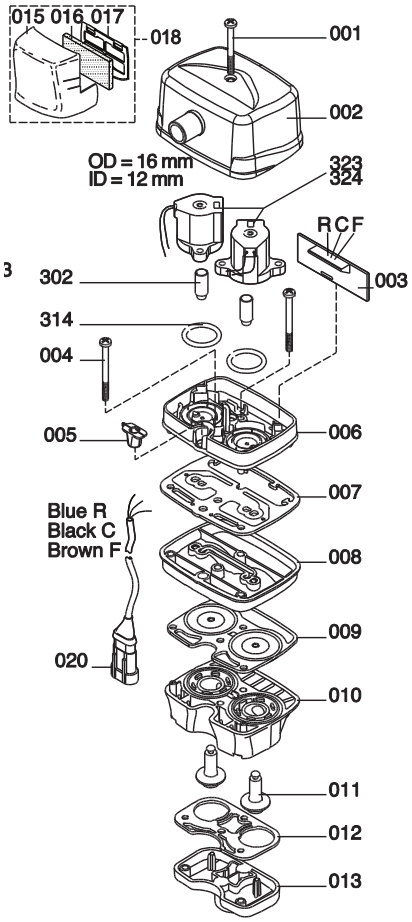
D. Excel file
E. graph
F. PDF File
G. A.I.A. File
H. Summary table

13 SPARE PARTS DIAGRAM

13.1 Portable iMilk401 Lite



13.2 LE30


015 016 017
018
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002
OD = 16 mm
ID = 12 mm
323
324
RCF
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Blue R
Black C
Brown F
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