

Overview of Commercially Available Digital Systems in Animal Husbandry

Range on offer largest for dairy cows, smallest for meat and dairy sheep / goats

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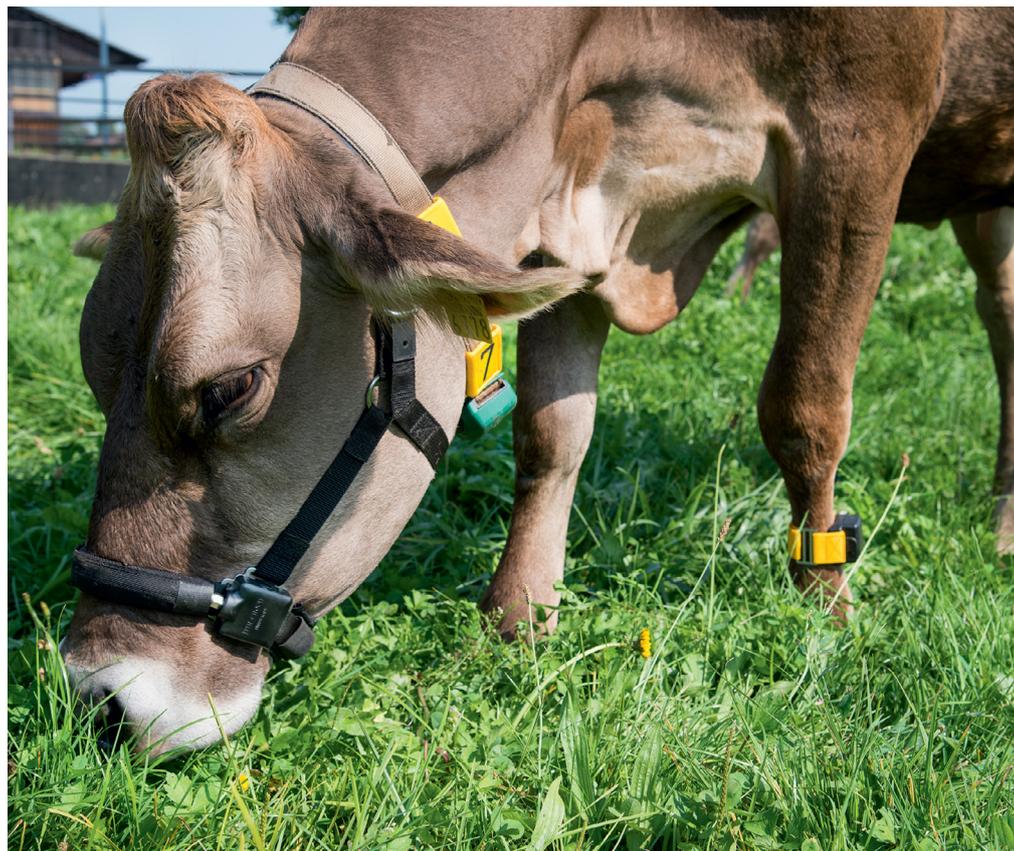


Photo: Gabriela Brändle, Agroscope

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Examples of sensors for dairy cows: The noseband sensor (RumiWatch) measures rumination, whilst the pedometer (RumiWatch) and neck sensor (Rescounter II from Nedap) detect activity.

This report gives an overview of the digital systems currently available on the international market that are suitable for the early detection of welfare and health problems in livestock. In addition to the functions and characteristics of the technologies, relevant literature on the validation of these systems – if available – is also listed. The systems were grouped

according to the following enterprises: dairy cows, veal calves, fattening pigs, breeding sows, laying hens and broilers, dairy and meat sheep/goats. Because digital systems are constantly being refined, renamed and their functions undergo modification, the information listed may be incomplete and quickly outdated.



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Federal Department of Economic Affairs
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Swiss Confederation

Introduction

Health problems in livestock lead to production losses, higher veterinary costs, and compromised welfare. For this reason, health monitoring plays an important role in animal husbandry. Early intervention is crucial for reducing the severity of a disease or preventing its further spread. Diseases often alter the physiology and behaviour of the animals. Such changes are normally perceived by farmers through time-consuming direct observation. However, as group sizes increase, it becomes increasingly difficult to ensure optimal health monitoring. Precision livestock farming (PLF) systems can offer support here. These usually consist of a hardware component (sensor) for collecting data and a software component for storing and analysing the data.

Many new systems are able to collect real-time animal-related data from individuals and groups of animals automatically, thereby supporting health monitoring. Since the range of such PLF technologies is steadily increasing, the aim of our research is to present an overview of commercially available PLF systems for the following enterprises: dairy cows, veal calves, fattening pigs, breeding sows, laying hens and broilers, and dairy and meat sheep/goats.

Methods

The search consisted of two parts: an internet search to compile the commercially available PLF systems, and a literature search of the relevant databases to gain an overview of which systems or parameters are validated. Based on the internet search, a summary of commercially available PLF systems was compiled for the enterprises dairy cows, veal calves, fattening pigs, breeding sows, laying hens and broilers, and dairy and meat sheep/goats. For this, the internet was searched according to PLF systems suitable for monitoring health and welfare. Tables with information on the functions and characteristics of the system were then produced for each enterprise, and each category within an enterprise (e.g. eating, activity, body temperature). Each system was assigned solely to the enterprise for which the system was, according to the suppliers, expressly provided. Other potential applications were not taken into account. An example of these would be weighing systems for sheep, which would most likely also be suitable for goats.

Our search took the following systems into account:

1. Those that were offered on the international market, and for which a system description in English and/or German could be found on the home page of the supplier;
2. Those consisting of a hardware component and a software component, the former serving to collect data, the latter transferring data, making said data available in a suitable format, and continuing to process it if necessary.
3. Those that are at least partially automated, i.e. either data collection or data transfer is fully automated.
4. Those that could be used for the early detection of welfare and health problems in the aforementioned livestock. This included only those systems collecting animal-based information such as physiological or behavioural parameters at individual or group level in real time. These data could be used to deduce information on the welfare or health status of the individual animal or group, or to trigger alarms automatically by means of an algorithm.

The format of the tables is based on the so-called «Technology Warehouse», which developed from the EU-financed thematic network «Data Driven Dairy Decisions for Farmers» (4D4F) (<https://4d4f.eu/content/technology-warehouse>). An overview of PLF systems for dairy cows has already been compiled there. The table for dairy cows reproduced here was recompiled based on the aforementioned criteria, but in many instances contains the same systems.

The wide range of milk meters for cows, which can also be used for a detailed milk analysis, was limited to ICAR-certified milk meters.

Studies on the validation of the commercially available PLF systems were compiled with the aid of the literature search. The aim here was to find a publication on the validation of each measured parameter. Publications in which the systems were used but not validated were not included in the overview.

For the search, the Google Scholar, Science Direct, NEBIS, PubMed, Scopus and Web of Science databases were used. First, we conducted a keyword search based on the names of the systems (e.g. SOMO, eYeNamic) and the manufacturer (e.g. SoundTalks, fancom). Since in many cases both the system names and the names of the manufacturers change over time, further keywords and combinations were used for the search. Among these were the name of the enterprise (e.g. «dairy cows», «broilers»), the description of the disease or symptoms (e.g. «mastitis», «lameness») or of the behaviour to be determined (e.g. «calving», «feeding»), the different terms for PLF technologies (e.g. «PLF», «smart sensors», «smart farming», «automatic monitoring systems», «health or welfare monitoring systems»), and clauses such as «validation of» and «development of».

Results Tables

Tab. 1: Commercial digital systems for monitoring the health of **veal calves** with the recorded characteristics, and available literature about the evaluation of the technologies.



Photo: Josef Schuler

- Feeding
- Water intake
- Weight
- Temperature

Depending upon its functions, a system can be listed in several categories.

Tab. 1.1. Feeding of Veal Calves

System	Manufacturer	Measurement	Target	Type of feed	Alert	Data availability	Production line	Note	Literature
Compact Smart	Förster Technik	Feed consumption Weight	Individual	Milk	Health	Real-time	Not specified		No
Vario Smart	Förster Technik	Feed consumption Weight	Individual	Milk	Health	Real-time	Not specified		No
H&L 100	Holm & Laue	Feed consumption Weight	Individual	Concentrates	Health	Real-time	Not specified		No
Lely Calm Compact +	Lely	Feed consumption Weight	Individual	Milk	Health	Real-time	Not specified		No
Lely Calm Vario +	Lely	Feed consumption Weight	Individual	Milk	Health	Real-time	Not specified		No
Biotic ID-TEK	Biotic Industries	Feed consumption	Individual	Milk	Health	Real-time	Not specified		No
DeLaval calf feeder CF150X	DeLaval	Feed consumption	Individual or group	Milk and concentrates	No	Real-time	Not specified		Janzekovic <i>et al.</i> , 2011 publication about the CF500
DairyFeed J C400+	GEA	Feeding behaviour	Individual	Milk	Health	Real-time	Not specified		No
DairyFeed V600+	GEA	Feeding behaviour	Individual	Milk	Health	Real-time	Not specified		No
DairyFeed V640	GEA	Feeding behaviour	Individual	Milk	Health	Real-time	Not specified		No
Urban Alma Pro	Urban	Milk consumption Number of visits Duration of visits Drinking speed	Individual	Milk	Health	Real-time	Not specified		No
Zeddy 500	Zeddy	Feed history	Individual	Concentrates	No	Real-time	Not specified		No
Zeddy 1250	Zeddy	Feed history	Individual	Concentrates	No	Real-time	Not specified		No
Smart Calf System	Förster Technik	Teat nudges activity Water consumption Positioning	Individual	Milk	Health	Real-time	Not specified		No

Tab. 1.2. Water Intake of Veal Calves

System	Manufacturer	Measurement	Target	Placement	Alert	Data availability	Production line	Note	Literature
Smart Calf System	Förster Technik	Water consumption Teat nudges activity Positioning	Individual	Neck	Health	Real-time	Not specified		No

Tab. 1.3. Weight of Veal Calves

System	Manufacturer	Measurement	Target	Alert	Data availability	Production line	Note	Literature
Calf scale	Förster Technik	Weight	Individual	No	Information not provided	Not specified		No
Compact Smart	Förster Technik	Weight Feed consumption	Individual	Health	Real-time	Not specified		No
Vario Smart	Förster Technik	Weight Feed consumption	Individual	Health	Real-time	Not specified		No
H&L 100	Holm & Laue	Weight Feed consumption	Individual	Health	Real-time	Not specified		No
Lely Calm Compact +	Lely	Weight Feed consumption	Individual	Health	Real-time	Not specified		No
Lely Calm Vario +	Lely	Weight Feed consumption	Individual	Health	Real-time	Not specified		No
Calf Star	Holm & Laue	Weight	Individual	Health	Real-time	Not specified		No

Tab. 1.4. Temperature of Veal Calves

System	Manufacturer	Measurement	Target	Alert	Data availability	Production line	Note	Literature
VitalControl	Urban	Rectal temperature	Individual	Health	While measuring	Not specified		No
Smart Thermometer	Förster Technik	Rectal temperature	Individual	No	While measuring	Not specified		No

 Tab. 2: Commercial digital systems for monitoring the health of **dairy cows** with the recorded characteristics, and available literature for the evaluation of the technologies.


Photo: Gro Elisabeth Holst

- Feed
- Water intake
- Activity
- Milk analysis
- Rumination
- Temperature
- Lameness
- Rumen acidosis
- Oestrus
- Body condition
- Calving

Depending upon its functions, a system can be listed in several categories.

Systems that are no longer or not yet available are shaded in yellow.

Tab. 2.1. Feeding of Dairy Cows

System	Manufacturer	Measurement	Placement	Alert	Data availability	Note	Literature
Cosmix	Lely	Concentrate feed consumption	Stationary feeder	No	Information not provided	Works with Qwes tags	No
CowControl	Nedap	Time and periods eating	Neck	Health	Real-time		No
Silent herdsmen	Afimilk	Feeding Activity Rumination	Neck	Oestrus Health	Information not provided		Konka <i>et al.</i> , 2014
CowScout Neck	GEA	Feeding time	Neck	Oestrus Health	Real-time		No

System	Manufacturer	Measurement	Placement	Alert	Data availability	Note	Literature
CowManager	CowManager	Eating time Temperature Activity Rumination Resting time Indoor positioning	Ear	Oestrus Health	Real-time		Pereira <i>et al.</i> , 2018 Borchers <i>et al.</i> , 2016
CowView	GEA	Feeding time Movement profile Lying Indoor positioning	Neck	Oestrus Health	Real-time		Tullo <i>et al.</i> , 2016
Heatime HR LD	SCR	Feeding Activity Rumination Heat length Time from the previous cycle	Neck	Oestrus Health Pre-Calving Distress Post-Calving Distress	Real-time		No
Heatime Pro	SCR	Feeding Activity Rumination Panting Heat length Time from the previous cycle	Neck and ear	Oestrus Health Pre-Calving Distress Post-Calving Distress Heat stress	Real-time		No
MooMonitor +	DAIRY-MASTER	Feeding time Resting time Activity time Rumination time	Neck	Oestrus Health	Real-time		Werner <i>et al.</i> , 2019
SenseHub	Various dealers	Reproductive status (based on activity, rumination, eating and other key behaviours)	Leg and ear	Oestrus Health	Information not provided	Name changed (before: Sense-Time)	No
FeedLive	Medria	Information not provided	Neck	Health	Information not provided	Name changed (before: Feed-Phone) Not available yet	Delagarde and Lemonnier, 2015 (FeedPhone)
Realtime	Boumatic	Consumption time Activity and rest periods Rumination time Indoor positioning	Neck	Oestrus Health	Real-time		No
Zeddy 1250	Zeddy	Feed history	Ear	Health	Real-time		No
ABS Breeder Tag System (Feedface)	Genus/ABS	Number of visits to the feed bunk Feeding duration at the feed bunk Activity	Leg	Oestrus Health Calving	Real-time		No
Ceres Tag	Ceres Tag	Feeding rate Movement Temperature Outdoor positioning	Ear	Health	Real-time		No
RumiWatch	ITIN-HOCH	Eating	Nose-band	No alerts yet (anno 2018), but raw data is available	While measuring		Werner <i>et al.</i> , 2019
Ovalert (Smart-tag Neck)	CRV (NL, BE)	Eating time Hours of eating Hours of not eating	Neck	Oestrus Health	Real-time		No
Ovalert (Smart-tag All in One)	CRV (NL, BE)	Eating time Hours of eating Hours of not eating Rumination Inactivity	Neck	Oestrus Health	Real-time		No
Heat Detective	InterPuls	Eating behaviour Indoor positioning	Neck	Health	Real-time		No
Smart camera	Cainthus	Variability in feeding behaviour	Camera	No	Real-time		No

Tab. 2.2. Water Intake of Dairy Cows

System	Manufacturer	Measurement	Placement	Alert	Data availability	Software	Note	Literature
SanPhone	Medria	Water consumption Rumen temperature	Rumen	Health	Real-time	Medria box		No
eBolus	eCow	Drinking activity	Rumen	No	Real-time	Information not provided		Mottram <i>et al.</i> , 2008

Tab. 2.3. Activity of Dairy Cows

System	Manufacturer	Measurement	Placement	Alerts	Data availability	Note	Literature
AfiAct II	Afimilk	Rest behaviour	Leg	Oestrus Calving Lameness (pilot)	Real-time		Borchers <i>et al.</i> , 2016
Activity meter system	DeLaval	Activity	Neck	Oestrus Health Calving	Real-time		No
Rescounter III	GEA	Activity	Leg or neck	Oestrus	Every 2 hours		No
CowAlert	Ice Robotics	Mobility Lying time	Leg	Oestrus Health Lameness	Real-time		Borchers <i>et al.</i> , 2016 Nielsen <i>et al.</i> , 2018
CowScout	GEA	Standing time Lying time Walking time Number of get ups Number of steps	Leg	Oestrus Health	Real-Time		Nielsen <i>et al.</i> , 2018
CowView	GEA	Movement profile Lying time Feeding time Indoor positioning	Neck	Oestrus Health	Real-time		Tullo <i>et al.</i> , 2016
HeatSeeker II	GEA	Activity	Leg	Oestrus Health	Real-time		At-Taras <i>et al.</i> , 2001
MooMonitor +	DAIRY-MASTER	Resting time Activity time Feeding time Rumination time	Neck	Oestrus Health	Real-time		Roessen <i>et al.</i> , 2015
Qwes cow-recognition system (H-LD Tag)	Lely	Activity	Neck	Oestrus Health	Every 2 hours		No
Qwes cow-recognition system (HR-LD Tag)	Lely	Activity Rumination activity	Neck	Oestrus Health	Every 2 hours		Molfino <i>et al.</i> , 2017
Qwes cow-recognition system ISO LD Smarttag	Lely	Activity Rumination Grazing	Neck	Oestrus Health	Real-time		No
Silent Herdsman	Afimilk	Activity Feeding behaviour Rumination	Neck	Oestrus Health	Information not provided		No
Heatime HR LD	SCR	Activity Rumination Feeding Heat length Time from the previous cycle	Neck	Oestrus Health Pre-Calving Distress Post-Calving Distress	Real-time		Dolecheck <i>et al.</i> , 2015
Heatime Pro	SCR	Activity Rumination Feeding Panting Heat length Time from the previous cycle	Neck or ear	Oestrus Health Pre-Calving Distress Post-Calving Distress Heat stress	Real-time		Dolecheck <i>et al.</i> , 2015 (Neck)
CowControl (Smarttag Leg)	Nedap	Standing time and periods Lying time and periods Walking time Number of steps Number of get ups	Leg	Oestrus Health	Real-time		No
ABS Breeder Tag System	ENG Systems	Activity Number of visits to the feed bunk Feeding duration at the feed bunk	Leg	Oestrus Health Calving	Real-time		Borchers <i>et al.</i> , 2016 (Oestrus)
RealTime (Smart-tag)	Boumatic	Activity and rest periods Rumination time Consumption time Indoor positioning	Neck	Oestrus Health	Real-time		No
Track A Cow	ENG Systems	Activity Lying-standing ratio	Leg	Oestrus	Real-time		No
Smartbow	Smartbow	Activity Rumination Indoor positioning	Ear	Oestrus Health	Real-time		No

System	Manufacturer	Measurement	Placement	Alerts	Data availability	Note	Literature
CowLar	COWLAR	Activity (movement and gait pattern) Temperature Rumination	Neck	Oestrus Health	Real-time		No
Rumiwatch	ITIN-HOCH	Lying Standing Walking Temperature	Leg	No alerts yet (anno 2018), but raw data is available	While Measuring		No
Ceres Tag	Ceres Tag	Movement Temperature Feeding rate Outdoor positioning	Ear	Health	Real-time		Pereira <i>et al.</i> , 2018
Digitanimal	Digitanimal	Activity Temperature Outdoor positioning	Neck	Activity Calving Temperature	Real-time		No
CowManager	CowManager	Activity Lying behaviour Rumination Eating time Temperature Indoor positioning	Ear	Oestrus Health	Real-time		No
HeatLive	Medria	Activity	Neck	Oestrus	Real-time		No
Ovalert (Smarttag All in One)	CRV (NL, BE)	Activity Rumination Eating time Hours of eating Hours of not eating	Neck	Oestrus Health	Real-time		No
Ovalert (Smarttag Leg)	CRV (NL, BE)	Lying time Number of stand ups Number of steps	Leg	Oestrus Health	Real-time		No
UHF Heat Detective	InterPuls	Standing Lying	Leg	Low activity	Real-time		No
Smart camera	Cainthus	Herd behaviour	Camera	Not specified	Information not provided		No

Tab. 2.4. Analysis of Cow's Milk

System	Manufacturer	Measurement	Cow / quarter measurements	Frequency of measurements	Alerts	Data availability	Software	Note	Literature
MQC	Lely	Conductivity Colour Temperature Milk production Fat Protein Lactose	Quarter: conductivity, temperature and colour Cow: fat, protein, lactose	Every milking	Mastitis	Real-time	T4C (+InHerd app)		No
MQC-C	Lely	Cell count (indication)	Cow	Every 3rd milking (depending on the health status of the udder)	Mastitis	Real-time	T4C (+InHerd app)		No
DeLaval Herd Navigator	DeLaval	Progesterone BHB LDH Urea in milk	Cow	Every milking	Fertility Mastitis Nutrition Energy balance (ketosis)	Real-time	DelPro Farm Manager	Calculated by biomodel depending on lactation status, health status, LDH level, etc.	Blom and Ridder, 2010
DeLaval OCC	DeLaval	Cell count	Cow	Optional every milking or reduced (every 24/72 hours depending on the health status of the udder)	Mastitis	Real-time	DelPro Farm Manager		Luis <i>et al.</i> , 2010
AfiLab	AfiMilk	Lactose concentration Colour (blood) Fat Protein	Cow	Every milking	Energy balance (ketosis) Acidosis Mastitis	Real-time	AfiMilk		Karp and Petersen-Wolfe, 2010
Crysta Lab	Fullwood	Lactose concentration Colour (blood) Fat Protein	Cow	Every milking	Energy balance (ketosis) Acidosis Mastitis	Real-time	Crystal		Miedema, 2011
Saber SCC	LIC Automation	Cell count	Cow	Information not provided	Mastitis	Real-time	Information not provided		No

Tab. 2.4. Analysis of Cow's Milk (cont'd.)

System	Manufacturer	Measurement	Cow / quarter measurements	Frequency of measurements	Alerts	Data availability	Software	Note	Literature
Saber Milk	LIC Automation	Yield Protein Fat Lactose Conductivity	Cow	Every Milking	Mastitis (indication)	Real-time	Information not provided		No
SmartD-TECT Sensor	Wakaite Milking Systems	Conductivity	Quarter	Every milking	Mastitis	Real-time	Information not provided		No
DairyMilk M6850	GEA	Indication of cell count	Quarter	Every milking	Mastitis	Real-time	Dairyplan		No
DeLaval milk meter MM27BC	DeLaval	Yield Conductivity	Cow	Every milking	No	Real-time	DelPro Farm Manager		No
Advanced Milk Meter	ENG5	Yield Conductivity Temperature	Cow	Every milking	No	Real-time	Milking management program		No
SmartFlow	Nedap	Yield	Cow	Every milking	No	Real-time	Nedap's dairy management system		No
Weighhall Milk Meters	DAIRYMASTER	Yield	Cow	Every milking	No	Real-time	DairyMaster Milk Manager system		No
Original Milk Meter	atl	Yield	Cow	Every milking	No	Real-time	Cowculator 2010		No
MM10 Milk Meter	atl	Yield	Cow	Every milking	No	Real-time	Cowculator M5		No
MM20 Milk Meter	atl	Yield Conductivity	Cow	Every milking	No	Real-time	Cowculator M5		No
MM30 Milk Meter	atl	Yield Conductivity	Cow	Every milking	Health	Real-time	Cowculator M5		No
MM35 Milk Meter	atl	Yield Conductivity	Cow	Every milking	Health	Real-time	Cowculator M5		No
MM60 Milk Meter	atl	Yield Conductivity	Cow	Every milking	No	Real-time	Cowculator M5		No
MM80 Milk Meter	atl	Yield Conductivity	Cow	Every milking	No	Real-time	Cowculator M5		No
SmartControl Meter	Boumatic	Yield Conductivity	Cow	Every milking	Health	Real-time	SmartDairy		No
LactoCorder	LactoCorder	Yield Conductivity Temperature	Cow	Every milking	No	Real-time	LactoPro		No
Electronic Milk Meter	Tru-Test	Yield	Cow	Every milking	No	Real-time	Smart software		No
Milk Yield Recording System	Nedap	Yield Conductivity	Cow	Every milking	Conductivity (Mastitis)	Real-time	Nedap Dairy Management System		No
iMilk600	InterPuls	Yield Temperature Conductivity	Cow	Every milking	Conductivity (Mastitis)	Real-time	Information not provided		No
Perfection 3000	BouMatic	Yield Conductivity	Cow	Every milking	Yes, but not specified	Real-time	ProVantage		No
Pulsameter 2	BouMatic	Information not provided	Cow	Every milking	No	Real-time	Management system		No
iMilk700	InterPuls	Yield Conductivity	Cow	Every milking	Conductivity (Mastitis)	Real-time	Information not provided		No
FirstLook Mastitis system	EIO Diagnostic	Thermal imaging: heat and swelling	Udder	By passing through	No	Real-time	Information not provided	Camera, no milk analysis	No
Agricam CaDDi Mastitis	Agricam	Thermal imaging: inflammation	Cow	By passing through	Mastitis	Real-time	Not specified	Camera, no milk analysis	No

Tab. 2.5. Rumination of Dairy Cows

System	Manufacturer	Battery life	Range	Measurement	Placement	Alerts	Data availability	Note	Literature
CowManager	CowManager	< 10 years	1000 m	Rumination Eating time Temperature Activity Resting time Indoor positioning	Ear	Oestrus Health	Real-time		Pereira <i>et al.</i> , 2018 Borchers <i>et al.</i> , 2016
Heitime HR LD	SCR	8 years	200-500 m	Rumination Activity Feeding Heat length Time from the previous cycle	Neck	Oestrus Health Pre-Calving Distress Post-Calving Distress	Real-time		Dolecheck <i>et al.</i> , 2015
Heitime Pro	SCR	8 years	200-500 m	Rumination Activity Feeding Panting Heat length Time from the previous cycle	Neck or ear	Oestrus Health Pre-Calving Distress Post-Calving Distress Heat stress	Real-time		Dolecheck <i>et al.</i> , 2015 (Neck)
MooMonitor +	DAIRY-MASTER	< 10 years	> 1000 m outdoors	Rumination time Resting time Activity time Feeding time	Neck	Oestrus Health	Real-time		Werner <i>et al.</i> , 2019
Qwes cow-recognition system (HR-LD Tag)	SCR	8 years	< 500 m	Rumination activity Activity	Neck	Oestrus Health	Real-time		Molfino <i>et al.</i> , 2017 Ambriz-Vilchis <i>et al.</i> , 2015
Qwes cow-recognition system ISO LD Smarttag	SCR	Information not provided	Information not provided	Rumination Activity Grazing	Neck	Oestrus Health	Real-time		No
Silent Herdsman	Afimiik	5 years	Closed barn = 100-150 m Open shed = 200-250 m Line of sight = >1000 m	Rumination Activity Eating pattern	Neck	Oestrus Health	Information not provided		Konka <i>et al.</i> , 2014
Smartbow	Smartbow	2 years	100 m indoors 500 m outdoors	Rumination Activity Indoor positioning	Ear	Oestrus Health Calving	Real-time		Borchers <i>et al.</i> , 2016
Rumi-Watch	ITIN-HOCH	2 years without SD-card logging; 100 days with SD-card logging (exchangeable batteries)	Information not provided	Jaw movement	Nose-band	No alerts yet (anno 2018), but raw data is available	While measuring		Werner <i>et al.</i> , 2019
FeedLive	Medria	> 6 years	> 200 m	Information not provided	Neck	Health	Information not provided	Name changed (before: FeedPhone) Not available yet	Delagarde and Lemonnier, 2015 (Feed-Phone)
RealTime	Nedap	< 10 years	< 100 m indoors < 1000 m outdoors	Rumination time Activity periods Rest periods Consumption time Indoor positioning	Neck	Oestrus Health	Real-time		No
SenseHub	SCR	7 years (neck tag) 3 years (ear tag)	200-500 m	Reproductive status (based on activity, rumination, eating and other key behaviours)	Leg and ear	Oestrus Health	Information not provided	Name changed (before: SenseTime)	No
Cow-Control (Smartag Neck)	Nedap	< 10 years	100 m indoors < 1000 m outdoors	Feeding Rumination Activity	Neck	Health	Real-time	Name changed	No

Tab. 2.5. Rumination of Dairy Cows (cont'd.)

System	Manufacturer	Battery life	Range	Measurement	Placement	Alerts	Data availability	Note	Literature
CowLar	COWLAR	< 6 months	> 3000m	Rumination Activity Temperature	Neck	Oestrus Health	Real-time		No
Ovalert (Smarttag All in One)	CRV	8 years	200-500m	Rumination Hours of eating Hours of not eating Activity	Neck	Oestrus Health	Real-time		No

Tab. 2.6. Temperature of Dairy Cows

System	Manufacturer	Measurement	Placement	Alerts	Data availability	Note	Literature
Fever Tag	FeverTags LLC	Temperature	Ear	Health	Real-time		No
TekVet System	TekVet Technologies	Temperature	Ear	Health	Every hour		No
CowManager	CowManager	Temperature Activity Resting time Rumination Eating time Indoor positioning	Ear	Oestrus Health	Real-time		No
Temperature Monitoring System	Phase IV Engineering	Temperature	Rumen	Health	Every time the cow walks by the reader		No
HerdStrong	DVM Systems LLC	Temperature	Rumen	Health Oestrus Calving	Real-time		No
SanPhone	Medria	Temperature	Rumen	Health	Real-time		No
Bella Ag Cattle Temperature System	BellaAg	Temperature	Rumen	Health	Real-time		Knauer <i>et al.</i> , 2016
eBolus	eCow Limited	Temperature pH	Rumen	Health	Real-time, but accessible after read out		No
WellCow Bolus	Well Cow	Temperature pH	Rumen	Health	Real-time, but accessible after read out		No
SmaXtec Basic/ Premium bolus	smaXtec animal care GmbH	Temperature pH	Rumen	Health Calving	Real-time		Gasteiner <i>et al.</i> , 2009
CowLar	COWLAR	Temperature Activity Rumination	Neck	Oestrus	Real-time		No
Ceres Tag	Ceres Tag	Temperature Movement Feeding rate Outdoor positioning	Ear	Health	Real-time		No
Digitanimal	Digitanimal	Temperature Activity Outdoor positioning	Neck	Oestrus Health	Real-time		No
VitalControl	Urban	Rectal temperature	Rectal	Health	While measuring		No
Moow Rumen Bolus	Moow	Rumen temperature Rumen pH	Rumen	No	Real-time		No
Smart Rumen Bolus	Moonsyst	Rumen temperature Rumen pH Rumen activity	Rumen	No	Real-time	Name changed (before VetAsyst)	Gábor Sályi

Tab. 2.7. Lameness of Dairy Cows

System	Manufacturer	Measurement	Placement	Alerts	Data availability	Software	Note	Literature
AfiActII	Afimilk	Rest behaviour	Leg	Heat Calving Lameness (pilot)	Real-time	AfiFarm 5.3	Not available yet	No
StepMetrix	BouMatic	Number of steps	Step Sensor Platform	Information not provided	Information not provided	StepMetrix Management Software	Not available yet	Van Nuffel <i>et al.</i> , 2015
Cow Alert	Ice Robotics	Lying time Movement	Leg	Lameness Heat Health	Real-time	Various herd management systems		No
Track A Cow	ENG Systems	Activity increase Irregular activity behaviour Lying standing ratio Daily steps per hour	Leg	Lameness Heat Health Mastitis	Real-time	EcoHerd		No

Tab. 2.8. Rumen Acidosis of Dairy Cows

System	Manufacturer	Lifespan	Measurement	pH accuracy	Alert	Data availability	Read-out	Note	Literature
eBolus	eCow	5 months	Rumen pH Rumen temperature	±0.1 pH	No	Real-time, but accessible after read out	Hand-held antenna		No
smaXtec Premium Bolus	smaXtec animal care GmbH	5 months	Rumen pH Rumen temperature Rumen activity	±0.2 pH	Health Oestrus Calving Heat stress	Real-time	Wireless		Klevenhusen <i>et al.</i> , 2014 Gasteiner <i>et al.</i> , 2009
Moow Rumen Bolus	Moow	3 years	Rumen pH Rumen temperature	unknown	No	Real-time	Wireless		No
Smart Rumen Bolus	Moon-syst	3 months	Rumen pH Rumen temperature Movement	unknown	No	Real-time	Wireless	Name changed (before: VetAsyst)	Gábor Sályi
Well Cow Bolus	Well Cow	80-100 days	Rumen pH Rumen temperature	± 0.3 pH	No	Real-time, but accessible after read out	Wireless		Phillips <i>et al.</i> , 2010

Tab. 2.9. Oestrus of Dairy Cows

System	Manufacturer	Battery life	Range	Measurement	Placement	Alert	Data availability	Note	Literature
Activity meter system	DeLaval	< 10 years	< 200 m	Activity	Neck	Oestrus Health Calving	Real-time		No
AfiAct II	Afimilk	5 years	80m in confined environment. 200m in open coral. Up to 500 m in pasture.	Activity	Leg	Oestrus Calving Lameness (pilot)	Real-time		Mayo <i>et al.</i> , 2019
Cow-Alert	Ice Robotics	5 years	Information not provided	Mobility Standing time Lying time	Leg	Oestrus Health Lameness	Real-time		Zebari <i>et al.</i> , 2019 Dolecheck <i>et al.</i> , 2015 Mayo <i>et al.</i> , 2019
Cow-Scout	Nedap	< 10 years	Up to 1000 m	Feeding time	Neck	Oestrus Health	Real-time		No
Cow-Scout	Nedap	< 10 years	Up to 1000 m	Standing time Lying time Walking time Number of get ups Number of steps	Leg	Oestrus Health	Real-time		Mayo <i>et al.</i> , 2019
Cow-Manager	Cow-Manager	< 10 years	1000 m	Temperature Activity Rumination Eating time Resting time Indoor positioning	Ear	Oestrus Health	Real-time		Dolecheck <i>et al.</i> , 2015 Mayo <i>et al.</i> , 2019
CowView	GEA	7 years	> 600 m	Movement profile Lying time Feeding time Indoor positioning	Neck	Oestrus Health	Real-time		No

Tab. 2.9. Oestrus of Dairy Cows (cont'd.)

System	Manufacturer	Battery life	Range	Measurement	Placement	Alert	Data availability	Note	Literature
Heatime HR LD	SCR	8 years	200-500 m	Oestrus-Index (based on activity, feeding, rumination and other key behaviours)	Neck	Oestrus Health Stress before calving Stress after calving	Real-time		Dolecheck <i>et al.</i> , 2015 Mayo <i>et al.</i> , 2019
Heatime Pro	SCR	8 years	200-500 m	Oestrus-Index (based on activity, feeding, rumination and other key behaviours)	Neck or ear	Oestrus Health Stress before calving Stress after calving Heat stress	Real-time		Dolecheck <i>et al.</i> , 2015 (Neck)
HeatSeeker II	Nedap	7 years	> 50 m indoors > 1000 m outdoors	Activity	Neck	Oestrus Health	Real-time	Name changed (before Heat-Seeker RT)	At-Taras and Spahr, 2001
HeatSeeker II	Nedap	7 years	> 50 m indoors > 1000 m outdoors	Activity	Leg	Oestrus Health	Real-time	Name changed (before Heat-Seeker RT)	No
Herd Navigator	Foss & DeLaval	Information not provided	Information not provided	Progesterone LDH Urea BHB	Milking parlour/ milking robot	Fertility Health (ketosis) Mastitis	Information not provided		No
MooCall Heat	Moocall	60 days - rechargeable	Information not provided	Mounting behaviour cow Bull proximity Bull activity levels	Neck (bull) + ear (cow)	Oestrus	Information not provided		No
MooMonitor +	DAIRY-MASTER	< 10 years	> 1000 m outdoors	Resting time Activity time Feeding time Rumination time	Neck	Oestrus Health	Real-time		No
Qwes cow-recognition system (H-LD Tag)	SCR	8 years	< 500 m	Activity	Neck	Oestrus Health	Real-time		No
Qwes cow-recognition system (HR-LD Tag)	SCR	8 years	< 500 m	Activity Rumination activity	Neck	Oestrus Health	Real-time		No
Qwes cow-recognition system ISO LD Smarttag	SCR	8 years	< 75 m	Rumination Activity Grazing	Neck	Oestrus	Real-time		No
Rescounter III	Nedap	< 10 years	5 m to fixed point	Activity	Leg and neck	Oestrus	Real-time		Zebari <i>et al.</i> , 2019 (RescounterII)
Silent Herdsman	Afimilk	5 years	Closed barn = 100-150 m Open shed = 200-250 m Line of sight = > 1000 m	Activity Feeding behaviour Rumination	Neck	Oestrus Health	Information not provided		No
Smartbow	Smartbow	2 years	100 m indoors 500 m outdoors	Activity Rumination Indoor Positioning	Ear	Oestrus Health	Real-time		Schweitzer <i>et al.</i> , 2019
CowControl (Smarttag Neck)	Nedap	< 10 years	100 m indoors < 1000 m outdoors	Time and periods eating Time and periods ruminating	Neck	Oestrus Health	Real-time	Name changed	Roelofs <i>et al.</i> , 2017
CowControl (Smarttag Leg)	Nedap	< 10 years	100 m indoors < 1000 m outdoors	Standing time and periods Lying time and periods Walking time Number of steps Number of get ups	Leg	Oestrus Health	Real-time	Name changed	Roelofs <i>et al.</i> , 2017 Roelofs <i>et al.</i> , 2005 Mayo <i>et al.</i> , 2019
SenseHub	SCR	7 years (neck tag) 3 years (ear tag)	200-500 m	Reproductive status (based on activity, rumination, eating and other key behaviours)	Neck and ear	Oestrus Health	Information not provided	Name changed (before: Sense-Time)	Chanvallon <i>et al.</i> , 2014
HeatLive	Medria	> 6 years	> 200 m	Activity	Neck	Oestrus	Real-time	Name changed (before: Heat-Phone)	Stein <i>et al.</i> , 2017

System	Manufacturer	Battery life	Range	Measurement	Placement	Alert	Data availability	Note	Literature
smaXtec Basic Bolus/ Premium Bolus	smaXtec animal care GmbH	Min. 4 years (but pH measurement 150 days)	10 to 30 meters, can be extended with smaXtec Repeaters	Rumen temperature Rumen activity Rumen pH	Rumen	Health Oestrus Calving Heat stress	Information not provided		No
ABS Breeder Tag System	ENGS Systems	5 years	> 700 m	Activity	Leg	Oestrus Health Calving	Real-time		
RealTime (SmartTag)	Nedap	< 10 years	< 100 m indoors < 1000 m outdoors	Activity Rest periods Rumination time Feeding time Indoor positioning	Neck	Oestrus Health	Real-time		Dolecheck et al., 2015 Mayo et al., 2019
Track A Cow	ENGS Systems	6 years (guarantee)	500–1000 m	Activity Lying-standing ratio	Leg	Oestrus	Real-time		Mayo et al., 2019
Ovalert (Smarttag Neck)	CRV	< 10 years	< 500–1000 m	Eating time Eating moment Hours of not eating	Neck	Oestrus Health	Real-time		No
Ovalert (Smarttag All in One)	CRV	8 years	200–500 m	Rumination Eating time Eating moment Hours of not eating Inactivity	Neck	Oestrus Health	Real-time		No
Ovalert (Smarttag Leg)	CRV	< 10 years	< 500–1000 m	Lying time Number of stand ups Number of steps	Leg	Oestrus Health	Real-time		No
UHF Heat Detective	InterPuls	Long lived	500–1000 m	Standing Lying	Leg	Low activity	Real-time		Dolecheck et al., 2015
Herd-Strong	DVM Systems LLC	> 5 years	173 m	Rumen temperature	Rumen	Health Oestrus Calving	Real-time		At-Taras and Spahr, 2001
Heat-Watch II	CowChips, LLC	Information not provided	Information not provided	Date of mount Time of day of the mount Duration of the mount	Tail	Oestrus	Information not provided		No
CowLar	COWLAR	< 6 months	> 3000 m	Activity Temperature Rumination	Neck	Oestrus Health	Real-time		No

Tab. 2.10. Body Condition of Dairy Cows

System	Manufacturer	Installation	Function	Target	Alerts	Data availability	Software	Note	Literature
DeLaval Body Condition Scoring (BCS)	DeLaval	Camera	Body condition scoring	Individual	Body condition scoring	Daily	Delpro Farm Manager		Mullins et al., 2019
BodyMat	Ingenera	Stationary and portable	Body condition scoring	Individual	Information not provided	Information not provided	Information not provided	Not available anymore	Biondi, 2015
Potrack BCS	LIC	Camera	Body condition scoring	Individual	Body condition scoring	Daily	MINDA Live		No
Dairy Scale	Gallagher	Stationary	Weighing	Herd and individual	Weight loss Missing animal	Information not provided	MyScale Pro		No
Taxatron 5000 animal weigher	GEA	Stationary	Weighing	Individual	Information not provided	Information not provided	DairyPlan C21		No
OptiCow	Hölschner + Leuschner	Stationary	Weighing Body condition scoring	Individual	Early detection of ketosis	Information not provided	Information not provided		No

Tab. 2.11. Calving

System	Manufacturer	Measurement	Placement	Time of installation	Alerts by	Time frame of alerts	Data availability	Note	Literature
Velphone	Medria	Temperature Expulsion of sensor	Vagina	8–10 days before calving	SMS text	Up to < 48h before calving	Real-time		No
Moocall	Moocall	Tail movement	Tail	2–3 days before calving	SMS text & email	< 1h before calving	Real-time		No
SmartVel	Evolution	Tail movement	Tail	5–8 days before calving	SMS & phone call	2h before calving	Real-time		No

Tab. 2.11. Calving (cont'd.)

System	Manufacturer	Measurement	Placement	Time of installation	Alerts by	Time frame of alerts	Data availability	Note	Literature
smaXtec Basic / Premium bolus	smaXtec animal care GmbH	Temperature Movement	Rumen	At least 8 days before calving	push notification, email	6–36h before calving	Real-time		No
CowOnWeb	CowOnWeb	Temperature	Vagina	4–21 days before calving	SMS or e-mail (fever or detachment)	Information not provided	Real-time		No
Cowcall	Cowcall	Expulsion of sensor	Vagina	14 days before calving	SMS & phone call	< 1h before calving	Real-time		No
Calvesense	Wasserbauer	Tail movement	Tail	Information not provided	Phone call or sms	Information not provided	Real-time		No
Alert Vel	ALB Innovation	Tail movement	Tail	14–21 days before calving	GSM	Information not provided	Real-time		No
Calving Alert	Patura	Tail movement	Tail	A few days before calving	Phone call	Information not provided	Real-time		No
Radco	Verdor	Temperature	Vagina	10–14 days before calving	Telephone or GSM	Information not provided	Real-time		No
Digitanimal	Digitanimal	Activity Temperature Outdoor positioning	Neck	Information not provided	App	Information not provided	Real-time		No
HerdStrong	DVM Systems LLC	Temperature	Rumen	Information not provided	Mobile or PC	Information not provided	Real-time		No

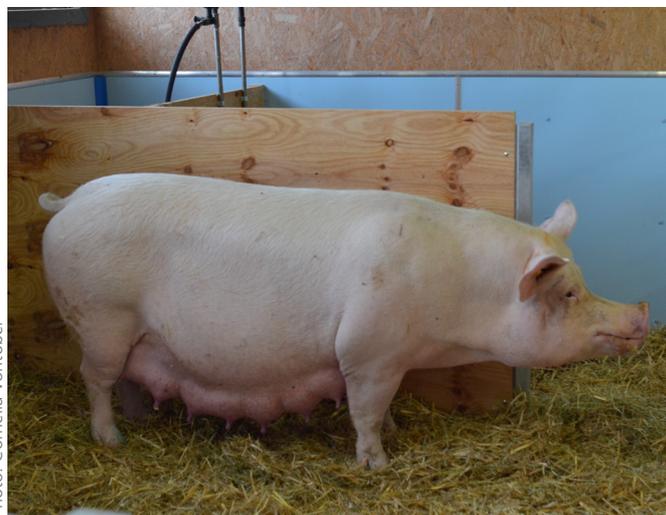
 Tab. 3: Commercial digital systems for monitoring the health of **breeding sows** with the recorded characteristics, and available literature for the evaluation of the technologies.


Photo: Cornelia Vontobel

- Feeding
- Oestrus
- Water intake
- Vocalisation
- Weighing
- Piglets

Depending upon its functions, a system can be listed in several categories.

Systems that are no longer or not yet available are shaded in yellow.

Tab. 3.1. Feeding of Sows

System	Manufacturer	Measurement	Target	Type of feed	Data availability	Note	Literature
ESF	Fancom	Feed consumption Weight	Individual	Three types of feed (not specified which)	Information not provided		Thomas <i>et al.</i> , 2018
SowSense	Nedap	Feed consumption Oestrus Weight	Individual	Information not provided	Real-time		No
ProSense	Nedap	Feed consumption Conversion ratio Weight	Individual	Information not provided	Real-time		No
EasySlider	Big Dutchman	Eating behaviour	Individual	Information not provided	Daily	Health monitoring possible	No

Tab. 3.2. Sow Oestrus

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
SowSense	Nedap	Behaviour of the sow Feed consumption Weight	Individual	Heat	Real-time		No
Boar Bot 2.0	Swine Robotics	Behaviour of the boar	Individual	No	While measuring		Sugai and Probst Miller, 2018
SmaRt suite for sows	Ro-Main	Behaviour of the sow	Individual	Heat Health	Real-time	PigWatch was the old system, pre-order of the new system possible	Klopfenstein <i>et al.</i> , 2016
Contact-O-Max	Ro-Main	Behaviour of the boar	Individual	No	While measuring		No

Tab. 3.3. Water Intake of Sows

System	Manufacturer	Measurement	Target	Data availability	Note	Literature
Water monitoring	Fancom	Water consumption	Group	Daily		No

Tab. 3.4. Vocalisation of Sows

System	Manufacturer	Measurement	Alert	Data availability	Software	Note	Literature
STREMODO	Information not provided	Calls	Stress	Real-time	Information not provided	Not available yet	No
PCM	Fancom	Coughs	Health	Real-time	Information not provided	No longer available due to the end of collaboration between Fancom and Sound talk (Now SOMO)	Hemeryck and Berckmans, 2015 Guarino <i>et al.</i> , 2008
SOMO I (portable)	SoundTalks	Coughs	Health	While measuring	SOMO RDM	Will soon not be available anymore	No
SOMO II	SoundTalks	Coughs	Health	Real-time	Information not provided	Available soon	No

Tab. 3.5. Weighing of Sows

System	Manufacturer	Function	Measurement	Target	Data availability	Note	Literature
SowSense	Nedap	Weighing	Weight Feed intake Feed conversion ratio	Individual	Real-time		No
ProSense	Nedap	Weighing and sorting	Weight	Individual	Real-time		No
Duo-Scan: Go	IMV	Body condition (portable)	Back fat	Individual	While measuring		No
Duo-Scan: Go Plus	IMV	Body condition (portable)	Back fat	Individual	While measuring		No
OptiFit	Hölschner + Leuschner	Body condition (stationary)	Not specified	Individual	Daily		No

Tab. 3.6. Piglets

System	Manufacturer	Function	Measurement	Target	Alert	Data availability	Note	Literature
Water monitoring	Fancom	Water monitoring	Water consumption	Group	No	Daily		No
SmartGuard	SWINE-TECH	Prevents piglet crushing	Vocalization	Individual	Crushing alert through vibration and an electrical impulse	Real-time		Mumm <i>et al.</i> (no year)
SmartGuard Plus	SWINE-TECH	Prevents piglet crushing	Vocalization	Individual	Crushing alert through vibration and an electrical impulse	Real-time	Soon available	No

Tab. 4: Commercial digital systems for monitoring the health of **fattening pigs** with the recorded characteristics, and available literature for the evaluation of the technologies.


Photo: Aifri Sell

- Feeding
- Water intake
- Activity
- Vocalisation
- Sorting and Weighing
- Temperature

Depending upon its functions, a system can be listed in several categories.

Systems that are no longer or not yet available are shaded in yellow.

Tab. 4.1. Feeding of Fattening Pigs

System	Manufacturer	Measurement	Target	Type of feed	Alert	Data availability	Note	Literature
Pork-Sense	Nedap	Weight Growth rate	Individual	Dry	No	Real-time	Sorting pigs to the right feeding area based on weight	No
Ceres Tag	Ceres Tag	Feeding rate Movement Temperature Outdoor positioning	Individual	Information not provided	Health	Real-time		No
ProSense	Nedap	Feed consumption Conversion ratio Weight	Individual	Information not provided	No	Real-time		No

Tab. 4.2. Water Intake of Fattening Pigs

System	Manufacturer	Measurement	Target	Data availability	Note	Literature
Water monitoring	Fancom	Water consumption	Group	Daily		No
Pig Scale	Pigscale	Water consumption Weight Temperature	Individual	Real-time		No

Tab. 4.3. Activity of Fattening Pigs

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Ceres Tag	Ceres Tag	Movement Feeding rate Temperature Outdoor positioning	Individual	Health	Real-time		No
SmaRt suit for pigs	Ro-Main	Speed Indoor positioning Stock density	Individual	No	Real-time	Soon available	No
RoiVISION	smartahc	Motion tracking Stock counting	Information not provided	No	Real-time		No

Tab. 4.4. Vocalisation of Fattening Pigs

System	Manufacturer	Measurement	Alert	Data availability	Software	Note	Literature
STREMODO	Information not provided	Calls	Stress	Real-time	Information not provided	Not available yet	No
PCM	Fancom	Coughs	Health	Real-time	Information not provided	No longer available due to the end of collaboration between Fancom and Sound talk (now SOMO)	Hemeryck and Berckmans, 2015 Guarino <i>et al.</i> , 2008
SOMO (portable)	SoundTalks	Coughs	Health	While measuring	SOMO RDM	Will soon not be available anymore	No
SOMO II	SoundTalks	Coughs	Health	Real-time	Information not provided	Available soon	No

Tab. 4.5. Sorting and Weighing of Fattening Pigs

System	Manufacturer	Function	Measurement	Target	Alert	Data availability	Note	Literature
eYeGrow	Fancom	Weighing	Weight growth per day	Group	No	Daily		Klement <i>et al.</i> , 2018
Pig Scale	Pigscale	Weighing and sorting Temperature Water consumption	Weight Water consumption Temperature	Individual	No	Real-time		Van Genugten and van der Peet-Schweiring, 2012
ProSense	Nedap	Weighing	Weight Feed intake Feed conversion ratio	Individual	No	Real-time		No
PorkSense	Nedap	Weighing and sorting	Weight	Individual	No	Real-time	Sorting pigs to the right feeding area based on weight	No
Automatic Pig Sorter	Arlyn Scales	Weighing and sorting	Weight	Individual	No	While measuring		No
Weight-Detect	PLF agritech	Weighing	Weight growth curve	Group	No	Real-time		No
Duo-Scan: Go	IMV	Body condition (portable)	Back fat	Individual	No	While measuring		No
Duo-Scan: Go Plus	IMV	Body condition (portable)	Back fat	Individual	No	While measuring		No
Wuggl One	Wuggl	Weighing (Camera, portable)	Weight	Individual	No	While measuring		No
Pigwei	Ymagine	Weighing (Camera, portable)	Weight	Individual	No	While measuring		Amat-Roldan, 2016
OptiScan	Hölschner + Leuschner	Weighing (Camera, portable)	Weight	individual	No	While measuring		No
Growth sensor	GroStat	Weighing	Weight Growth rate Pen uniformity	Group	No	Daily (real-time)		No
idol-69-camera	Doi	Weighing and sorting	Weight Weight gain	Group and individual	Low performance	Daily	Soon available	No

Tab. 4.6. Temperature of Fattening Pigs

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Ceres Tag	Ceres Tag	Temperature Feeding rate Movement Outdoor positioning	Individual	Health	Real-time		No
RoiDOC	smartahc	Temperature	Individual	Temperature	Real-time		No
Pig Scale	Pigscale	Temperature Water consumption Weight	Individual	No	Real-time		No

Tab. 5: Commercial digital systems for monitoring the health of **sheep** with the recorded characteristics, and available literature for the evaluation of the technologies.


Photo: Dr. Camille Raoult

- Feeding
- Water intake
- Activity
- Milk analysis
- Sorting and weighing
- Temperature
- Lambs

Depending upon its functions, a system can be listed in several categories.

Systems that are no longer or not yet available are shaded in yellow.

Tab. 5.1. Feeding of Sheep

System	Manufacturer	Measurement	Placement	Alert	Data availability	Enterprise	Note	Literature
Ceres Tag	Ceres Tag	Feeding rate Movement Temperature Outdoor positioning	Ear	Health	Real-time	Dairy Meat Wool		No

Tab. 5.2. Water Intake of Sheep

System	Manufacturer	Measurement	Placement	Alert	Data availability	Enterprise	Note	Literature
SanPhone	Medria	Water consumption Rumen temperature	Rumen	Health	Real-time	Not specified		No

Tab. 5.3. Activity of Sheep

System	Manufacturer	Measurement	Placement	Alert	Data availability	Enterprise	Note	Literature
Digitanimal	Digitanimal	Activity level Temperature Outdoor positioning	Neck	Health	Real-time	Not specified		No
Ceres Tag	Ceres Tag	Movement Feeding rate Temperature Outdoor positioning	Ear	Health	Real-time	Dairy Meat Wool		No

Tab. 5.4. Analyse of Ewe's Milk

System	Manufacturer	Function	Measurement	Alert	Data availability	Software	Enterprise	Note	Literature
Lactocorder T-T	Tru-Test Ltd	Milk meter	Yield	No	Information not provided	Information not provided	Dairy	ICAR approved milk meter for sheep, webpage cannot be found	ICAR
Lactocorder-S	WMB AG	Milk meter	Yield	No	Information not provided	Information not provided	Dairy	ICAR approved milk meter for sheep, webpage cannot be found	ICAR
MM 25SG	DeLaval	Milk meter	Yield	No	Information not provided	Information not provided	Dairy	ICAR approved milk meter for sheep, webpage cannot be found	ICAR
OpiFlow™ System	SCR	Milk monitoring	Yield Lactation Fertility	Health	Real-time	Information not provided	Dairy		No

System	Manufacturer	Function	Measurement	Alert	Data availability	Software	Enterprise	Note	Literature
AfiFree 155	AfiMilk	Milk meter	Yield Conductivity Flow rate	Health	Information not provided	AfiShephard	Dairy	ICAR approved milk meter for sheep, webpage cannot be found	ICAR
ALT	ALT	Milk meter	Yield	Health	Real-time	ATL Cowculator	Dairy		No
Original Milk Meter	ALT	Milk meter	Yield	No	Real-time	Cowculator 2010	Dairy		No
MM10 Milk Meter	ALT	Milk meter	Yield	No	Real-time	Cowculator M5	Dairy		No
MM20 Milk Meter	ALT	Milk meter	Yield Conductivity	No	Real-time	Cowculator M5	Dairy		No
MM30 Milk Meter	ALT	Milk meter	Yield Conductivity	Health	Real-time	Cowculator M5	Dairy		No
MM35 Milk Meter	ALT	Milk meter	Yield Conductivity	Health	Real-time	Cowculator M5	Dairy		No
MM60 Milk Meter	ALT	Milk meter	Yield Conductivity	No	Real-time	Cowculator M5	Dairy		No
MM80 Milk Meter	ALT	Milk meter	Yield Conductivity	No	Real-time	Cowculator M5	Dairy		No
Milk Recording	GreenOak	Milk meter	Milk records	No	Real-time	Parlour Server Management system	Dairy		No
iMilk401 S&G	InterPuls	Milk meter	Yield Conductivity	Conductivity (Mastitis)	Real-time	Dairy Management Software	Dairy		No

Tab. 5.5. Sorting and Weighing of Sheep

System	Manufacturer	Function	Target	Alert	Data availability	Software	Enterprise	Note	Literature
WSS 3000	BioControl	Weighing and sorting	Individual	No	While measuring	BioControl	Not specified		No
Sheep auto drafter	Gallagher	Weighing	Individual	No	While measuring	APS Professional	Not specified		No
Shearwell EID Sheep Management Crate	Shearwell	Weighing	Individual	No	While measuring	Race Reader and Stock Recorder	Not specified		No

Tab. 5.6. Temperature of Sheep

System	Manufacturer	Measurement	Placement	Alert	Data availability	Enterprise	Note	Literature
Digitanimal	Digitanimal	Temperature Activity Outdoor positioning	Neck	Health	Real-time	Not specified		No
SanPhone	Medria	Rumen temperature Water consumption	Rumen	Health	Real-time	Not specified		No
Ceres Tag	Ceres Tag	Temperature Movement Feeding rate Outdoor positioning	Ear	Health	Real-time	Dairy Meat Wool		No

Tab. 5.7. Lambs

System	Manufacturer	Function	Measurement	Target	Alert	Data availability	Enterprise	Note	Literature
Urban Alma Pro L	Urban	Automatic feeder	Number of visits Duration of visits Milk consumption Drinking speed	Individual	Health	Real-time	Not specified		No

Tab. 6: Commercial digital systems for monitoring the health of **goats** with the recorded characteristics, and available literature for the evaluation of the technologies.


Photo: Dr. Joanna Stachowicz

- Feeding
- Water Intake
- Activity
- Milk Analysis
- Sorting and Weighing
- Temperature
- Kids

Depending upon its functions, a system can be listed in several categories.

Systems that are no longer or not yet available are shaded in yellow.

Tab. 6.1. Feeding of Goats

System	Manufacturer	Measurement	Target	Type of feed	Alert	Data availability	Enterprise	Note	Literature
Zeddy 500	Zeddy	Feed history	Individual	Concentrates	No	Real-time	Not specified		No
Zeddy 1250	Zeddy	Feed history	Individual	Concentrates	No	Real-time	Not specified		No
Ceres Tag	Ceres Tag	Feeding rate Movement Temperature Outdoor positioning	Individual	Roughage	Health	Real-time	Dairy Meat		No

Tab. 6.2. Water Intake of Goats

System	Manufacturer	Measurement	Placement	Alert	Data availability	Enterprise	Note	Literature
SanPhone	Medria	Water consumption Rumen temperature	Rumen	Health	Real-time	Not specified		No

Tab. 6.3. Activity of Goats

System	Manufacturer	Measurement	Placement	Alert	Data availability	Enterprise	Note	Literature
Digitanimal	Digitanimal	Activity level Temperature Outdoor positioning	Neck	Health	Real-time	Not specified		No
Ceres Tag	Ceres Tag	Movement Feeding rate Temperature Outdoor positioning	Ear	Health	Real-time	Dairy Meat		No

Tab. 6.4. Analysis of Goat's Milk

System	Manufacturer	Function	Measurement	Alert	Data availability	Software	Enterprise	Note	Literature
Lacto-corder	WMB AG	Milk meter	Yield Conductivity Milk temperature Flow rate Fat Protein Lactose Dry mass	No	Information not provided	Information not provided	Dairy	ICAR approved milk meter for goats, webpage cannot be found	ICAR
Lacto-corder T-T	Tru-Test Ltd	Milk meter	Yield	No	Information not provided	Information not provided	Dairy	ICAR approved milk meter for goats, webpage cannot be found	ICAR

System	Manufacturer	Function	Measurement	Alert	Data availability	Software	Enterprise	Note	Literature
Lactocorder-S	WMB AG	Milk meter	Yield	No	Information not provided	Information not provided	Dairy	ICAR approved milk meter for goats, webpage cannot be found	ICAR
MM 25SG	DeLaval	Milk meter	Yield	No	Information not provided	Information not provided	Dairy	ICAR approved milk meter for goats, webpage cannot be found	ICAR
OpiFlow™ System	SCR	Milk monitoring	Yield Lactation Fertility	Health	Real-time	Information not provided	Dairy		No
AfiFree 155	AfiMilk	Milk meter	Yield Conductivity Flow rate	Mastitis	Information not provided	AfiShepherd	Dairy	ICAR approved milk meter for goats, webpage cannot be found	ICAR
ALT	ALT	Milk meter	Yield	Health	Real-time	ALT Cowculator	Dairy		No
Original Milk Meter	ALT	Milk meter	Yield	No	Real-time	Cowculator 2010	Dairy		No
MM10 Milk Meter	ALT	Milk meter	Yield	No	Real-time	Cowculator M5	Dairy		No
MM20 Milk Meter	ALT	Milk meter	Yield Conductivity	No	Real-time	Cowculator M5	Dairy		No
MM30 Milk Meter	ALT	Milk meter	Yield Conductivity	Health	Real-time	Cowculator M5	Dairy		No
MM35 Milk Meter	ALT	Milk meter	Yield Conductivity	Health	Real-time	Cowculator M5	Dairy		No
MM60 Milk Meter	ALT	Milk meter	Yield Conductivity	No	Real-time	Cowculator M5	Dairy		No
MM80 Milk Meter	ALT	Milk meter	Yield Conductivity	No	Real-time	Cowculator M5	Dairy		No
Milk Recording	GreenOak	Milk meter	Milk records	Health	Real-time	Parlour Server Management system	Dairy		No
iMilk401 S&G	InterPuls	Milk meter	Yield Conductivity	Conductivity (Mastitis)	Real-time	Dairy Management Software	Dairy		No

Tab. 6.5. Sorting and Weighing of Goats

System	Manufacturer	Installation	Function	Measurement	Target	Data availability	Enterprise	Note	Literature
WSS 3000	BioControl	Stationary/ portable	Weighing and sorting	Weight	Individual	While measuring	Not specified		No

Tab. 6.6. Temperature of Goats

System	Manufacturer	Measurement	Placement	Alert	Data availability	Enterprise	Note	Literature
Digitanimal	Digitanimal	Temperature Activity Outdoor positioning	Neck	Health	Real-time	Not specified		No
SanPhone	Medria	Rumen temperature Water consumption	Rumen	Health	Real-time	Not specified		No
Ceres Tag	Ceres Tag	Temperature Movement Feeding rate Outdoor positioning	Ear	Health	Real-time	Dairy Meat		No

Tab. 6.7. Kids

System	Manufacturer	Function	Measurement	Target	Alert	Data availability	Enterprise	Note	Literature
Urban Alma Pro L	Urban	Automatic feeder	Number of visits Duration of visits Milk consumption Drinking speed	Individual	Health	Real-time	Not specified		No

Tab. 7: Commercial digital systems for monitoring the health of laying hens with the recorded characteristics, and available literature for the evaluation of the technologies.


Photo: Dr. Sabine Gebhardt

- Feeding
- Water intake
- Activity
- Weight

Depending upon its functions, a system can be listed in several categories.

Tab. 7.1. Feeding of Laying Hens

System	Manufacturer	Measurement	Target	Type of feed	Alert	Data availability	Note	Literature
EasyBatch	Fancom	Feed consumption	Group	Silo	No	Information not provided		No
EasyBin	Fancom	Feed consumption	Group	Silo	No	Information not provided		No
Production control	SKOV	Feed consumption Water consumption Weight	Group	Information not provided	No	Information not provided		No

Tab. 7.2. Water Intake of Laying Hens

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Climate controller	Fancom	Water consumption	Group	No	Daily		No
ChickScale	AgroLogic	Water consumption Weight	Group	Health	Daily		No
Production control	SKOV	Water consumption Feed consumption Weight	Group	No	Information not provided		No

Tab. 7.3. Activity of Laying Hens

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Automatic poultry weighing system	Fancom	Activity Weight Growth Number of weighings Uniformity Day number	Group	No	Daily		No

Tab. 7.4. Weight of Laying Hens

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Automatic poultry weighing system	Fancom	Weight Growth Number of weighings Uniformity Day number Activity pattern	Group	No	Daily		No
ComScale	Big Dutchman	Weight Number of weighings Weight gain Uniformity	Group	No	Daily		No
ChickScale	AgroLogic	Weight Water consumption	Group	Health	Daily		No

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Production control	SKOV	Weight Water consumption Feed consumption	Group	No	Information not provided		No
Poultry Weighing System	Opticon	Information not provided	Information not provided	Information not provided	Information not provided		No

Tab. 8: Commercial digital systems for monitoring the health of broilers with the recorded characteristics, and available literature for the evaluation of the technologies.



Photo: Dr. Sabine Gebhardt

- Feed
- Water intake
- Activity
- Group behaviour
- Weight
- Digestion

Depending upon its functions, a system can be listed in several categories.

Tab. 8.1. Feeding of Broilers

System	Manufacturer	Measurement	Target	Type of feed	Alert	Data availability	Note	Literature
Metabolic Robots	Metabolic Robots	Information not provided	Group	Information not provided	Potential disease Feeding malfunction	Real-time		No
EasyBatch	Fancom	Feed consumption	Group	Silo	No	Information not provided		No
EasyBin	Fancom	Feed consumption	Group	Silo	No	Information not provided		No
Feeding Watering Technology	Hölschner + Leuschner	Feed curve	Group	Information not provided	No	Information not provided		No
Production control	SKOV	Feed consumption Water consumption Weight	Group	Information not provided	No	Information not provided		No

Tab. 8.2. Water Intake of Broilers

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Climate controller	Fancom	Water consumption	Group	No	Daily		No
BroMaxx	Jansen	Water consumption	Group	No	Information not provided		No
Chick Scale	AgroLogic	Water consumption Weight	Group	Health	Daily		No
Production control	SKOV	Water consumption Feed consumption Weight	Group	No	Information not provided		No

Tab. 8.3. Activity of Broilers

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Automatic poultry weighing system	Fancom	Activity Weight Growth Number of weighings Uniformity Day number	Group	No	Daily		No
eYeNamic	Fancom	Flock distribution	Group	Abnormal behaviour	Real-time		Kashiha <i>et al.</i> , 2013 Peña Fernandez <i>et al.</i> , 2018

Tab. 8.4. Group Behaviour of Broilers

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
eYeNamic	Fancom	Flock distribution	Group	Abnormal behaviour	Real-time		Kashiha <i>et al.</i> , 2013 Peña Fernandez <i>et al.</i> , 2018

Tab. 8.5. Weight of Broilers

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
Automatic poultry weighing system	Fancom	Weight Growth Number of weighings Uniformity Day number Activity pattern	Group	No	Daily		No
BAT 2	VEIT	Number of weighings Average weight Uniformity Daily gain	Group	No	Daily		No
ComScale	Big Dutchman	Weight Number of weighings Weight gain Uniformity	Group	No	Daily		No
Chick Scale	AgroLogic	Weight Water consumption	Group	Health	Daily		No
Bird Scale	Canarm	Weight Uniformity	Group	No	Information not provided		No
Bird Scales	Plasson	Average weight Weight gain Number of weighings	Group	No	Daily		No
Poultry Weighing System	Opticon	Information not provided	Information not provided	Information not provided	Information not provided		No
Bird Scale	CHORE-TIME	Weight Uniformity	Group	No	Information not provided		No
Production control	SKOV	Weight Feed consumption Water consumption	Group	No	Information not provided		No

Tab. 8.6. Digestion of Broilers

System	Manufacturer	Measurement	Target	Alert	Data availability	Note	Literature
ChickenBoy	Faromatics	Litter (digesting index) Identification of dead birds Air quality	Group	Health	Real-time		No

Summary

The compilation shows that the range of PLF technologies on offer varies greatly from one enterprise to another. The greatest range on offer, both in terms of the number of system types and the number of suppliers within a system type, is for dairy cows. Fattening pigs and broilers follow in second place, whilst the range of PLF systems that could be used for the early detection of welfare and health problems in breeding sows, laying hens, veal calves, dairy and meat sheep and goats is very small.

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