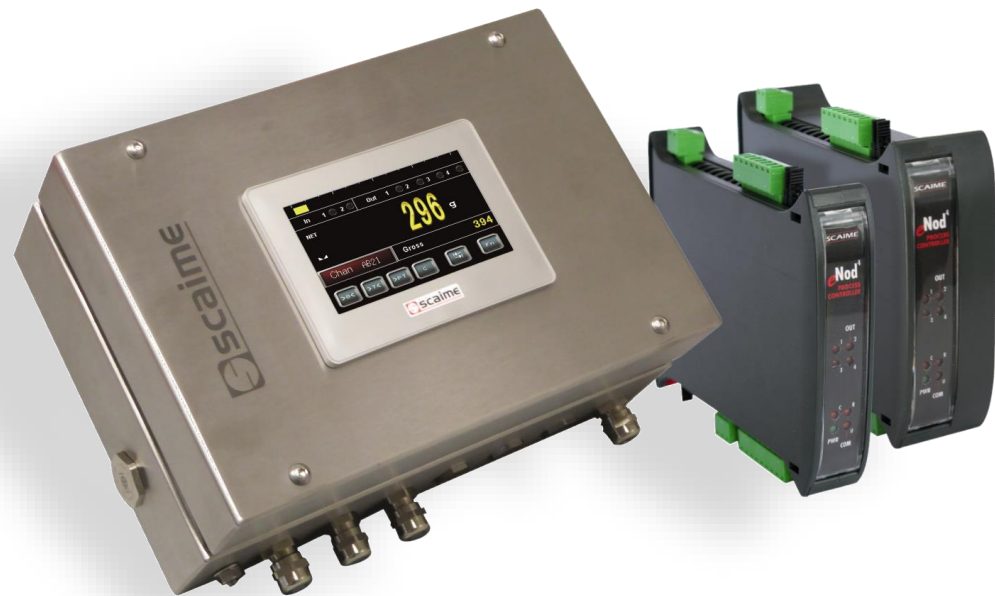


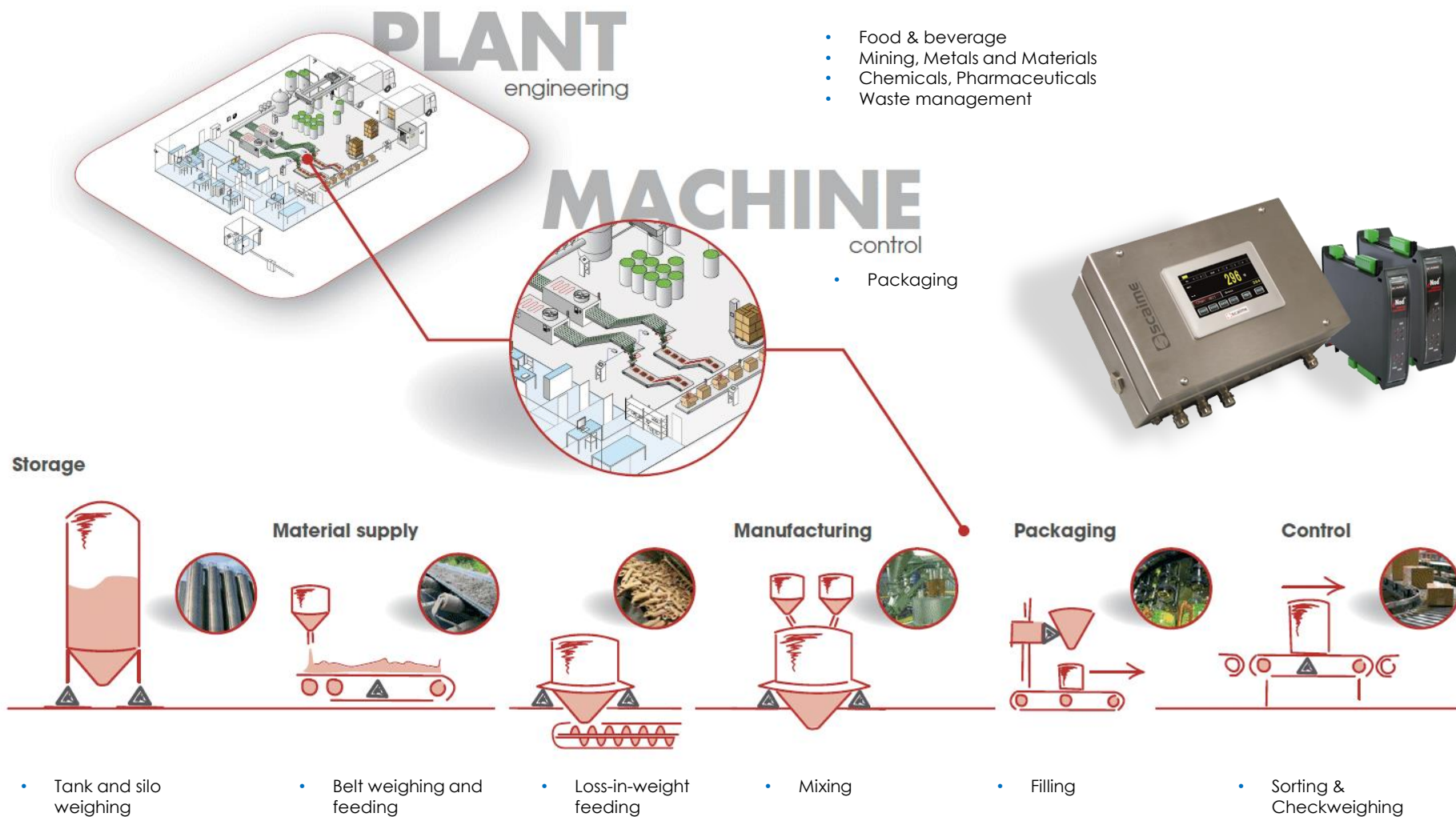
eNod4 weighing controllers

For automated processes



Introduction

A weighing solution for the entire supply chain



Introduction

A communicating and scalable solution easily integrated into automated systems

Flexible communication at reduced costs

- Extensive connectivity with full access to the configuration and application control.



Native diagnosis and quick replacement

- Some models include a diagnosis of the measuring system.
- Module replacement without recalibration



Open concept and easy implementation

- Unrestrained access for configuration, process data and application control.



Reliability and Optimized Performance

- Versions with comprehensive and customizable application to unload PLC



Introduction

A weighing solution especially designed for automated systems

► **A unique and versatile platform...**

- A common structure for all your weighing applications
- Connectivity to the main industrial networks
- A single tools for settings and implementation

► **Efficient...**

- High accuracy and measurement rate
- Embedded applications

► **Safe...**

- Diagnostic functions of the measuring system
- Validated connectivity with Schneider Electric architectures

► **And scalable...**

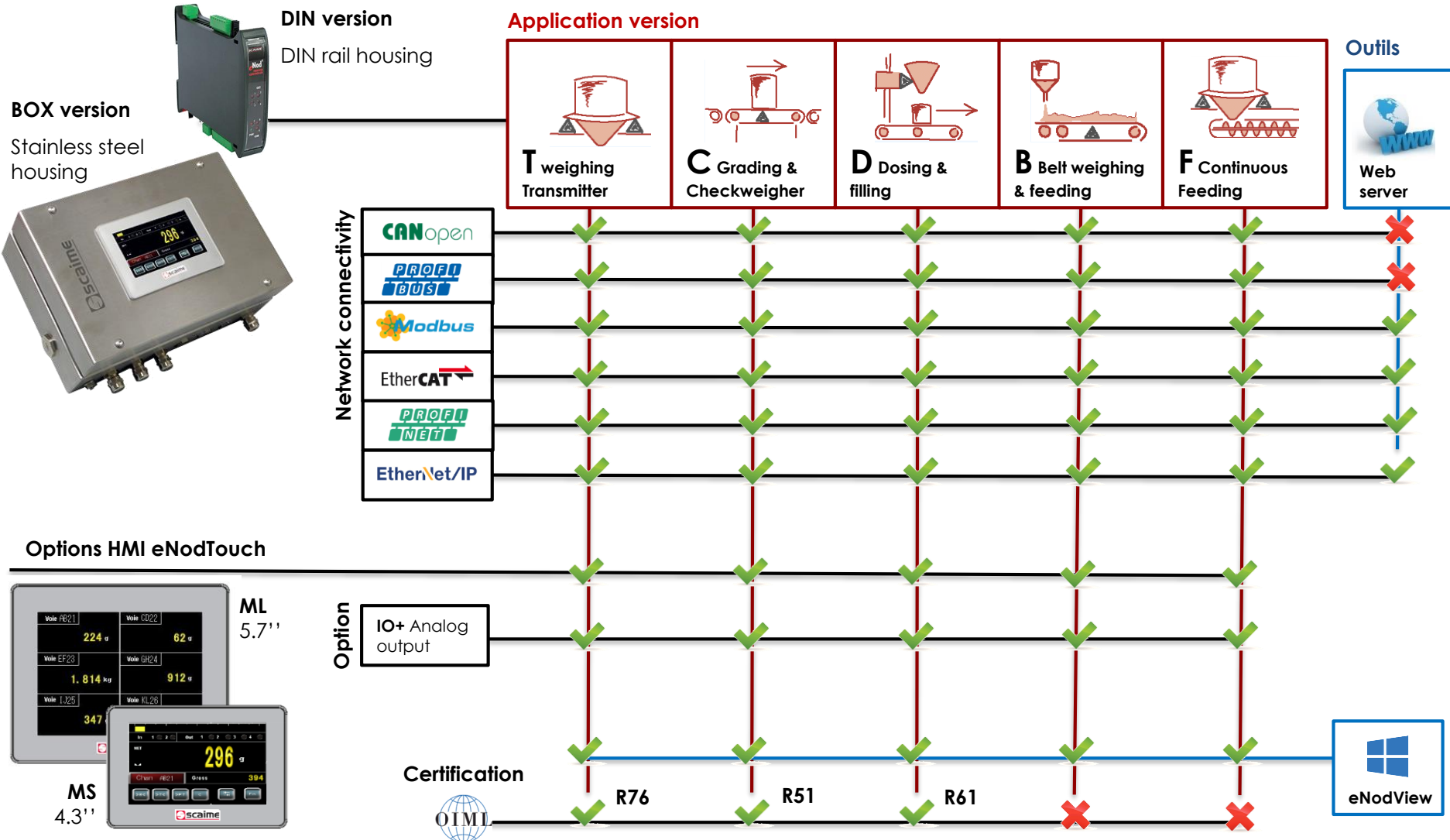
- Operation with or without PLC
- Several HMI available depending on user needs

Benefits

- **Performance**
 - increased productivity
 - Improved quality of products
 - Higher rates
- **Safety**
 - Safe operation
 - proven Solution
- **Saving**
 - Reduced development costs
 - Modular approach



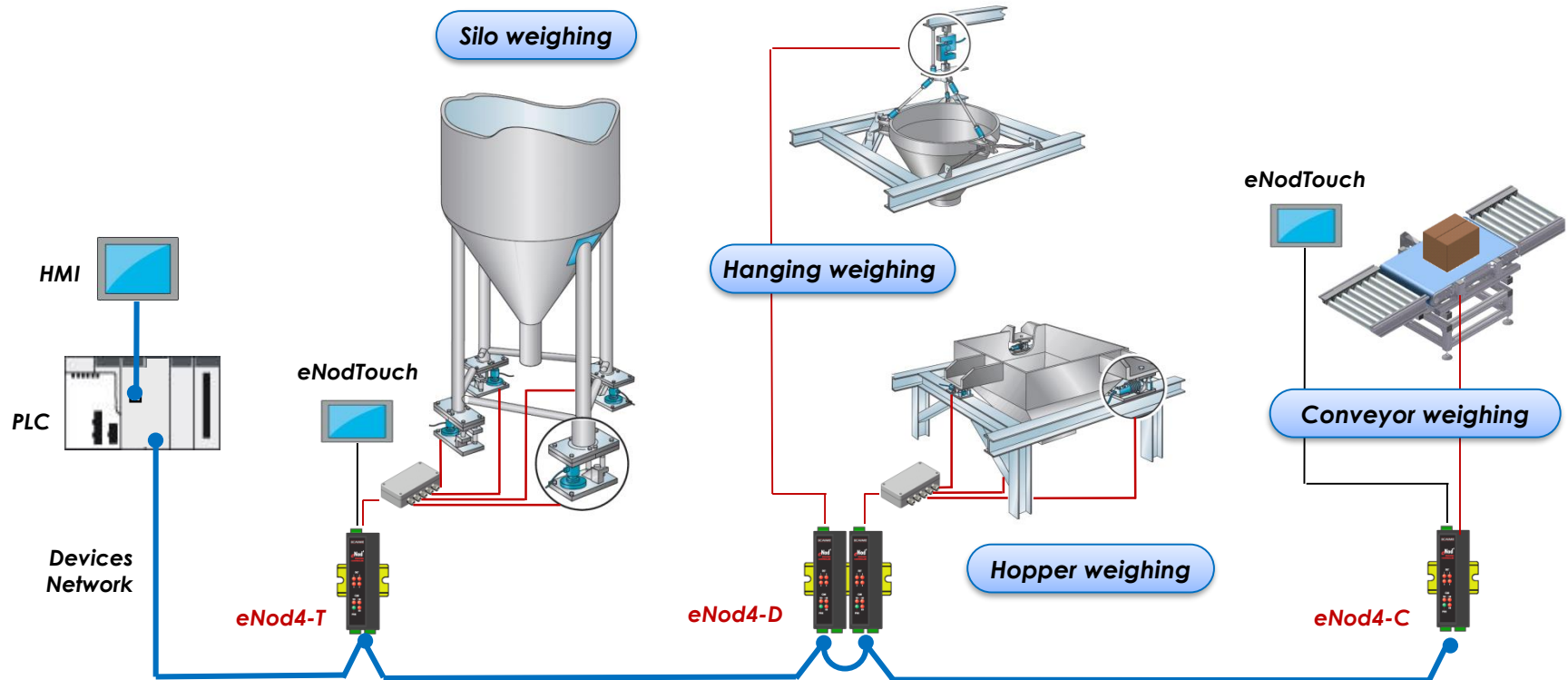
eNod4 at a glance



Architecture

Typical weighing architecture with eNod4

- ▶ Several eNod4 with different application firmware on the same industrial network
- ▶ Optional use of eNodTouch HMI for local display or control



DIN version – Vertical DIN rail housing

- **Vertical and compact size housing allowing quick and easy installation on DIN rail**



Presentation

BOX version, BJ model – IP65 stainless steel housing , without HMI

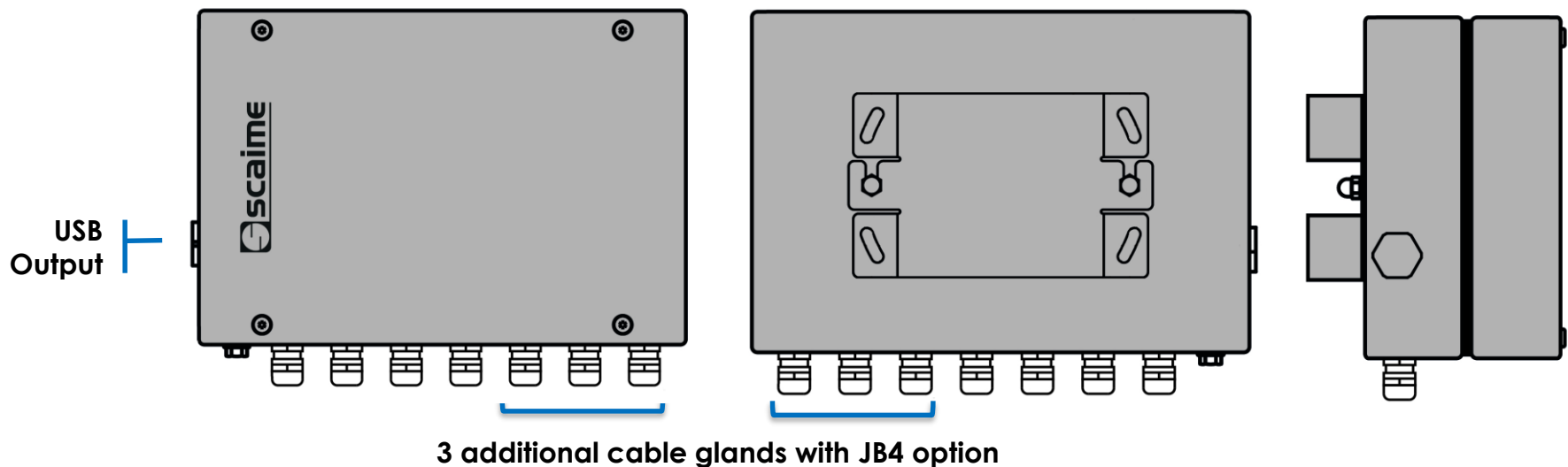


► Robust design for use in industrial environment

- Removable wall mount
- 110-220VAC Power supply Option
- JB4 connection board option for 4 Load cells

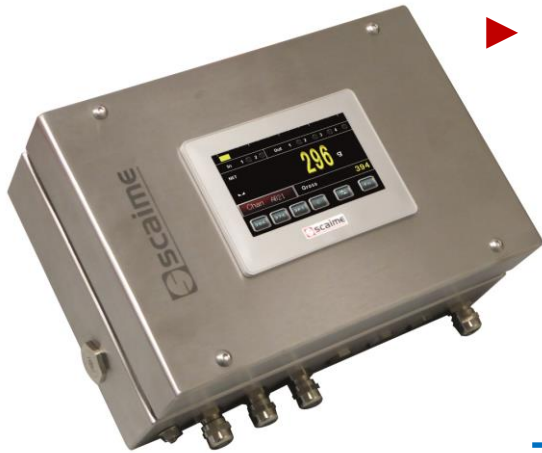


Optional swivel wall bracket



Presentation

BOX version, BS/BL models – IP65 stainless steel housing, with HMI eNodTouch-MS/ML

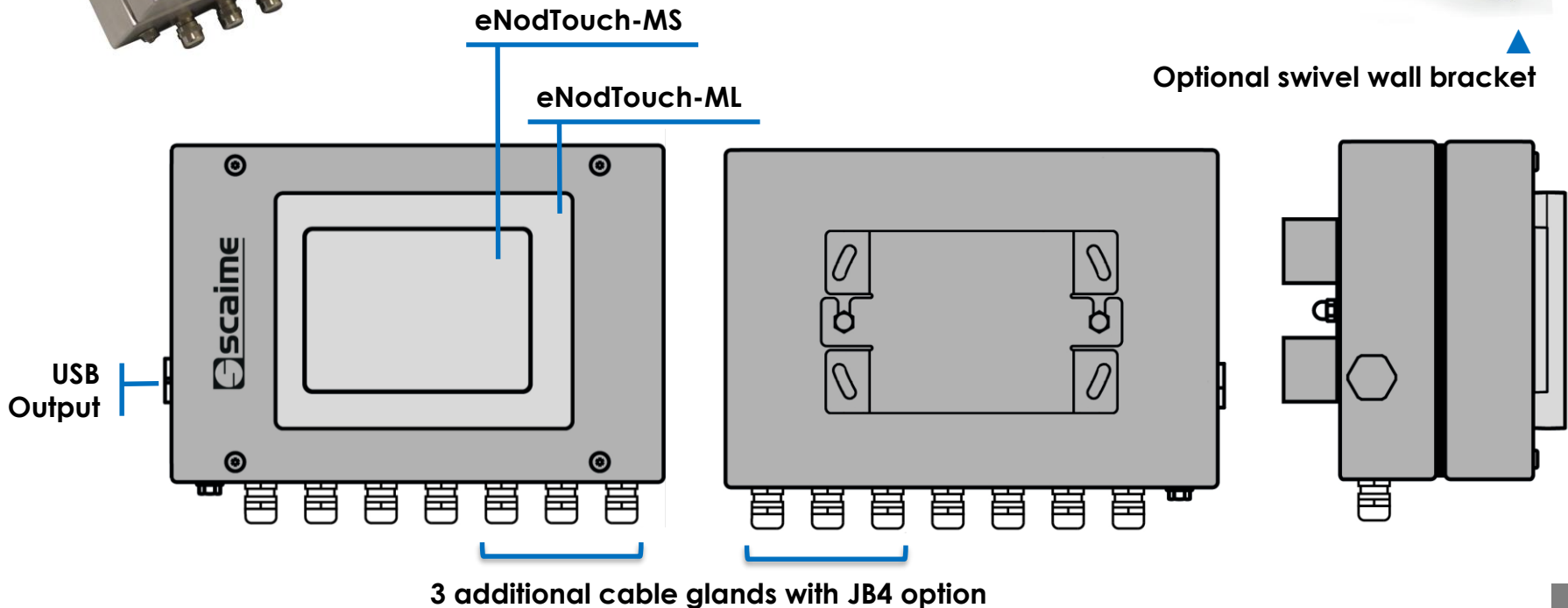


► Robust design for use in industrial environment

- Removable wall mount
- 110-220VAC Power supply Option
- JB4 connection board option for 4 Load cells



Optional swivel wall bracket



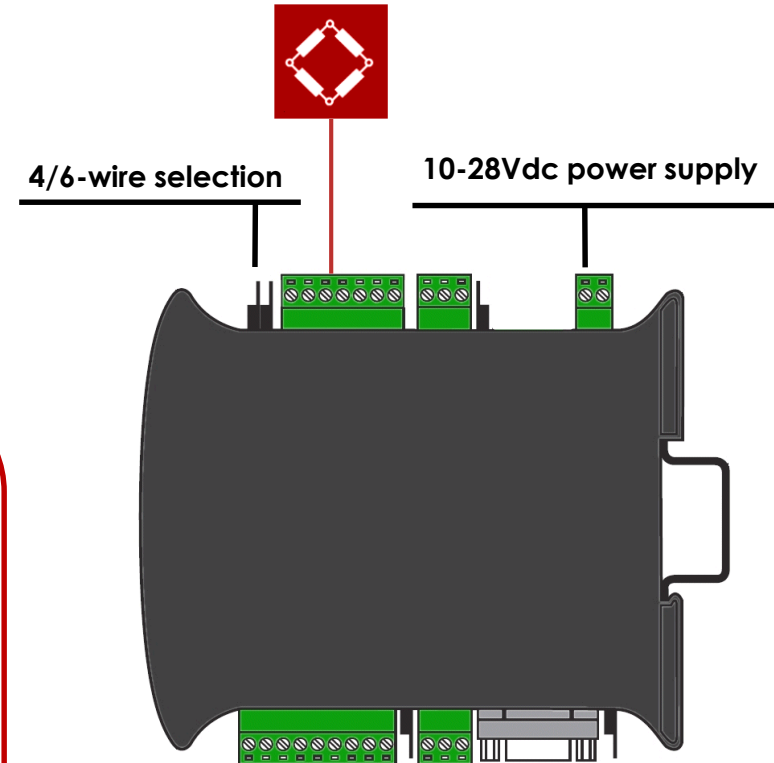
Load cells input

Load cells interface

- ▶ Supplies up to 8 strain gage load cells (350 Ω)
- ▶ Manage 4 or 6-wire load cell technology



- ▶ **Factory precalibration**
 - Calibrated at 500 000d for 2mV/V
 - Allows the exchange of a defective eNod4 without the need to recalibrate.
- ▶ **Weighing system diagnosis (eNod4-B & F)**
 - Break detection of sensor cable
 - Device simulating a load application by shunt resistor.
 - Can be triggered at any time by the PLC.



Digital Inputs/Outputs

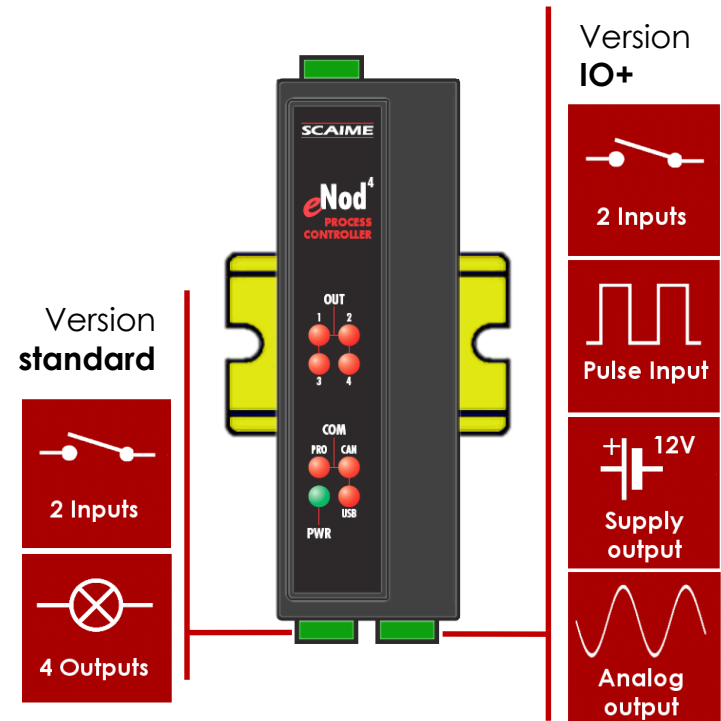
To control the embedded application

► Included as a standard

- **2 configurable opto-isolated inputs:** External triggering of weighing commands (Tare, Zero...) or process commands.
- **4 configurable outputs on static relay:** Process control, alarms, set points control or remote control

► With IO+ versions

- **2 additional digital inputs**
- **Pulse opto-isolated input for belt speed sensor,** TTL (5V) or HTL (24V) signal, frequency up to 4kHz
- **12VDC power supply output** for speed sensor
- **Configurable analog output 0-10V or 4-20mA,** 16 bit resolution

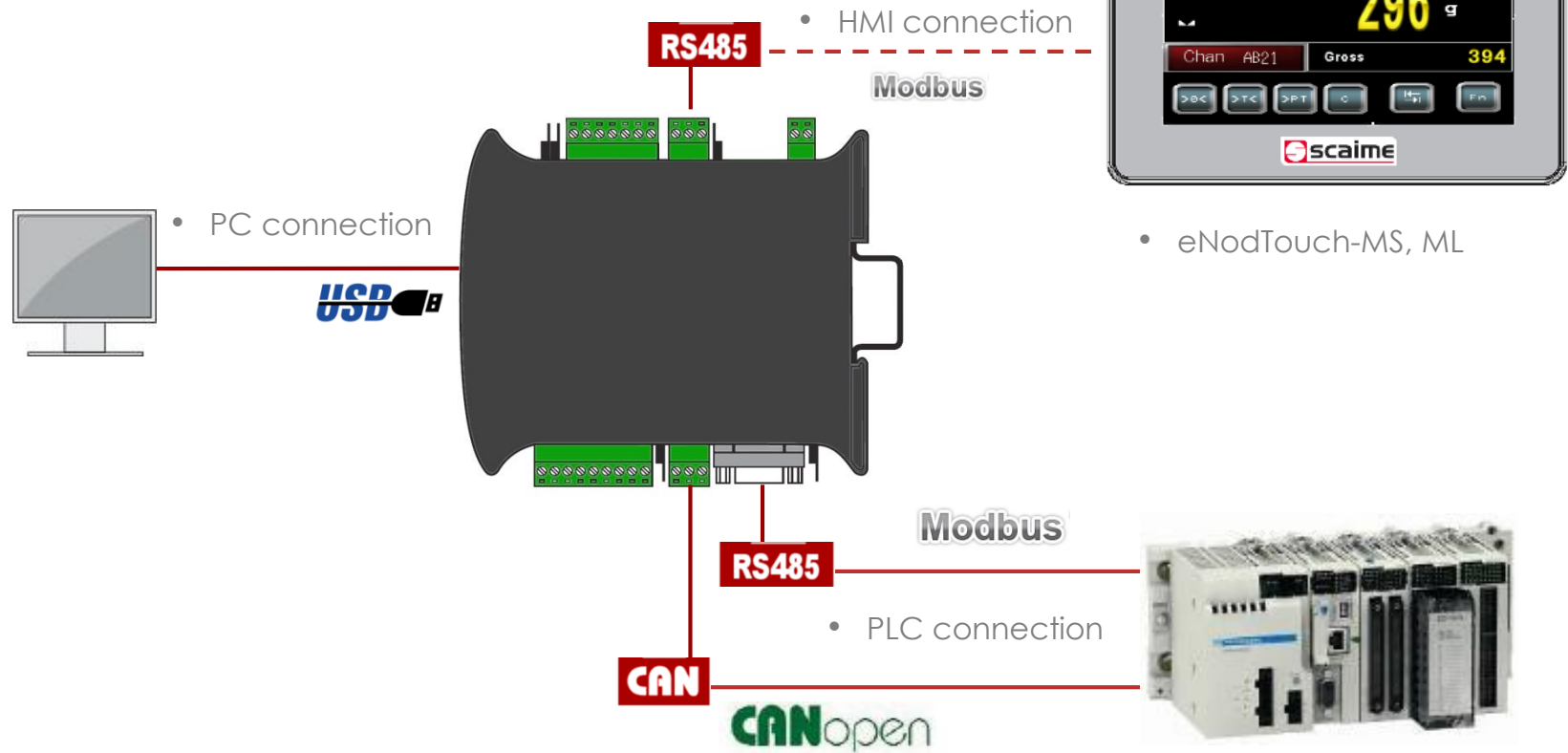


	eNod4-T	eNod4-C	eNod4-D	eNod4-B	eNod4-F
Analog output	Net weight Gross weight Remote value (could be updated by PLC)			Net/ Gross weight Remote value PID control output Flow rate Belt speed	Net/ Gross weight Remote value PID control output Flow rate

Connectivity

Standard eNod4 connectivity

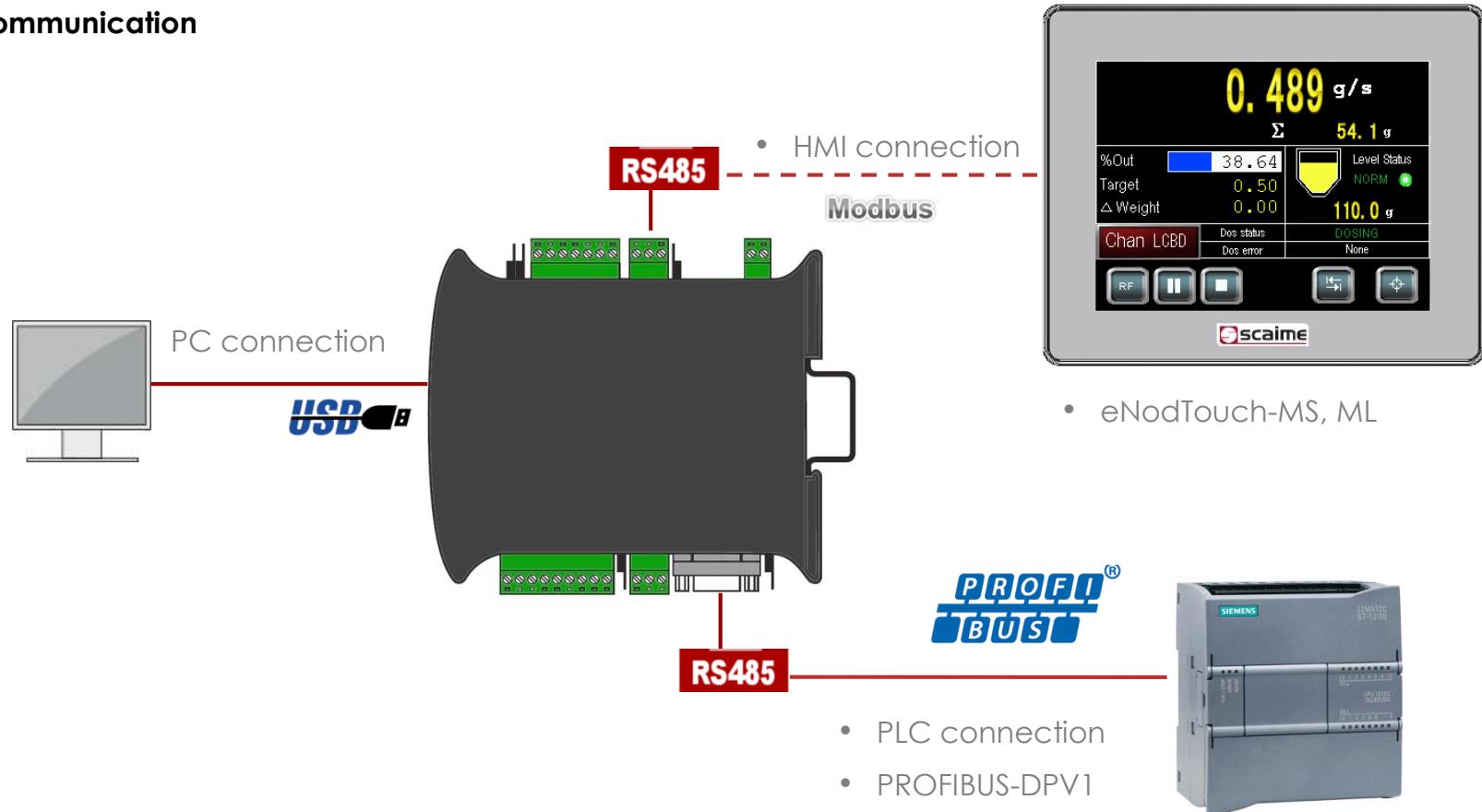
► Simultaneous HMI and PLC communication



Connectivity

eNod4 PROFIBUS connectivity

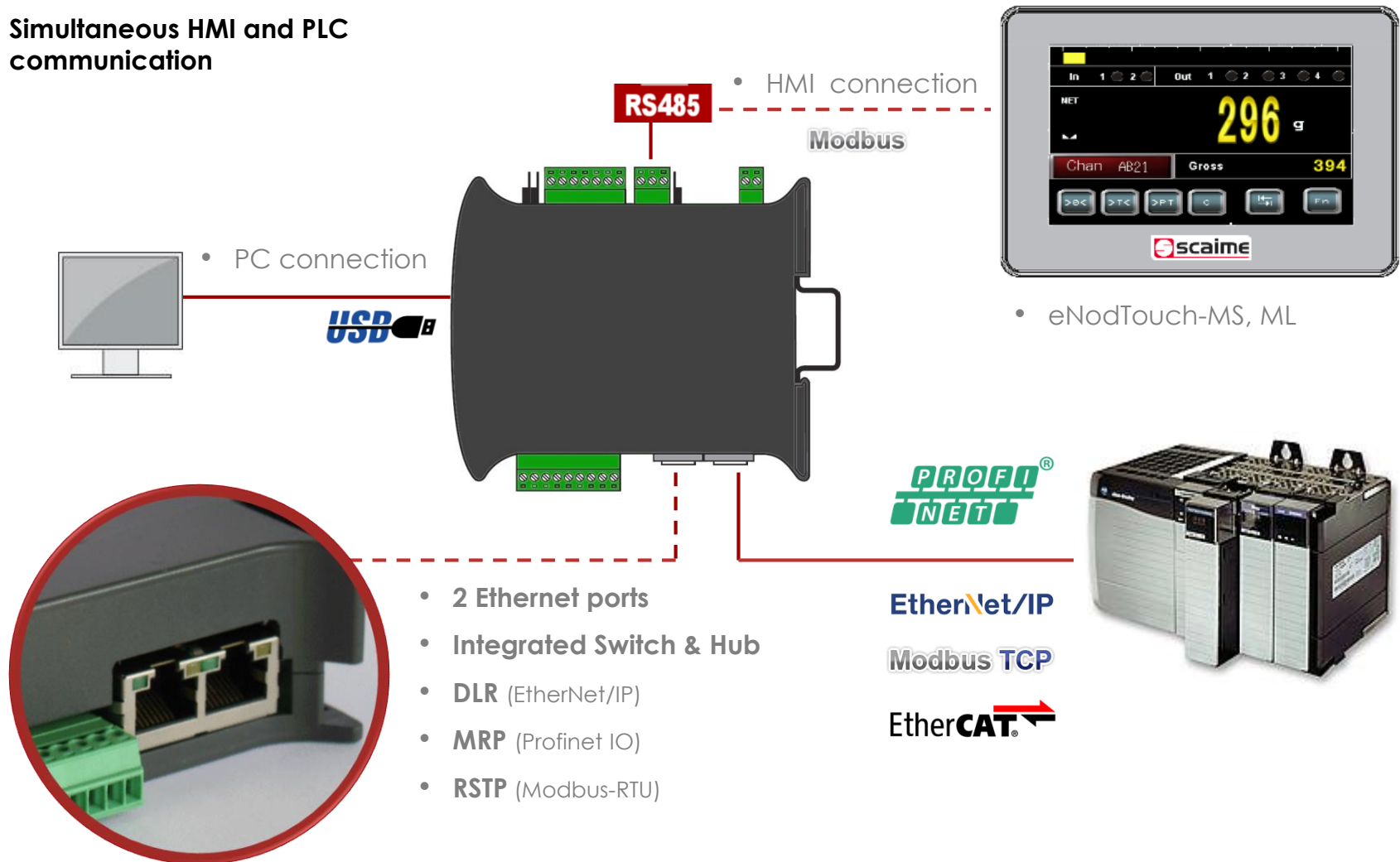
- ▶ Simultaneous HMI and PLC communication



Connectivity

eNod4 ETHERNET connectivity

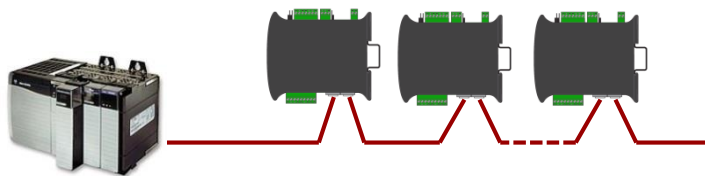
► Simultaneous HMI and PLC communication



Connectivity

eNod4 ETHERNET network topologies

- Linear « Daisy Chain » topology



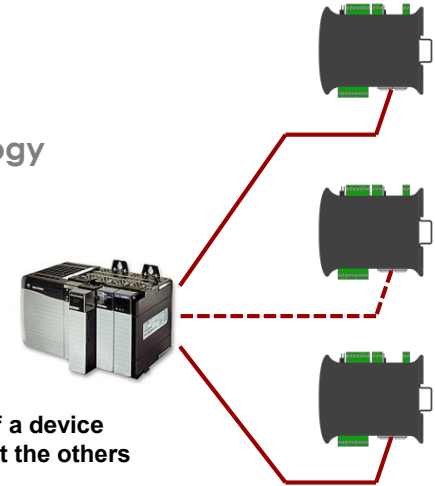
- + Easy and low-cost wiring
- The failure of a device affects the following on the line

Modbus TCP

EtherNet/IP

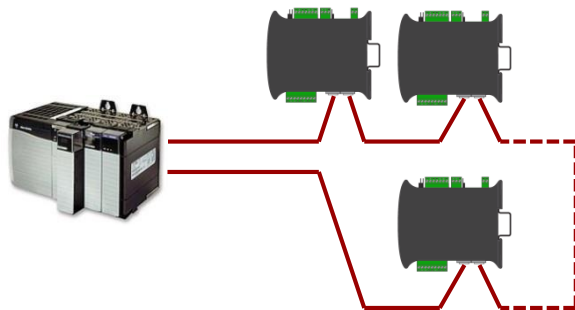
PROFI[®]
NET

- Star topology



- + The failure of a device doesn't affect the others
- Complex and costly wiring

- Ring « Daisy Chain » topology: DLR (EtherNet/IP), MRP (Profinet IO), RSTP (Modbus-RTU)



- + Easy and low-cost wiring
The failure of a device doesn't affect the following on the line
- PLC have to manage DLR, MRP or RSTP

EtherNet/IP

PROFI[®]
NET

Modbus TCP

DLR : Device Level Ring

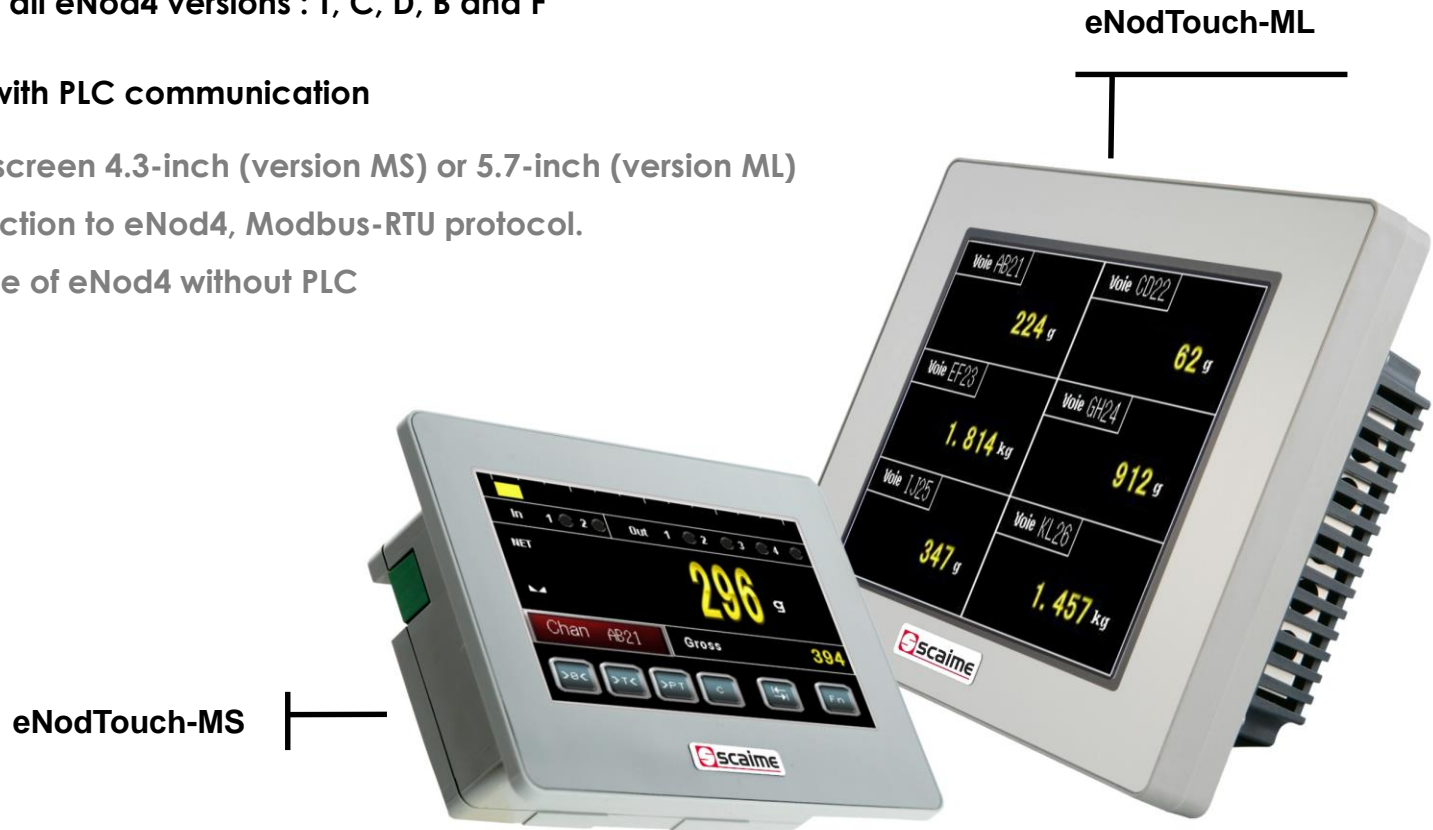
MRP : Media Redundant Protocol

RSTP : Rapid Spanning Tree Protocol

Optional HMI

eNodTouch-MS or ML, Multi-channel color touchscreen for eNod4

- ▶ Compatible with all eNod4 versions : T, C, D, B and F
- ▶ Runs in parallel with PLC communication
 - Color touch screen 4.3-inch (version MS) or 5.7-inch (version ML)
 - RS485 connection to eNod4, Modbus-RTU protocol.
 - Allows the use of eNod4 without PLC



- ▶ eNodTouch will display the weighing data, send commands and configure eNod4.

Optional HMI

Functionalities

► Display

- Weight and results display
- Weighing functions keys
- Application control



► Calibration

- Setting the calibration parameters
- Physical and Theoretical Calibration



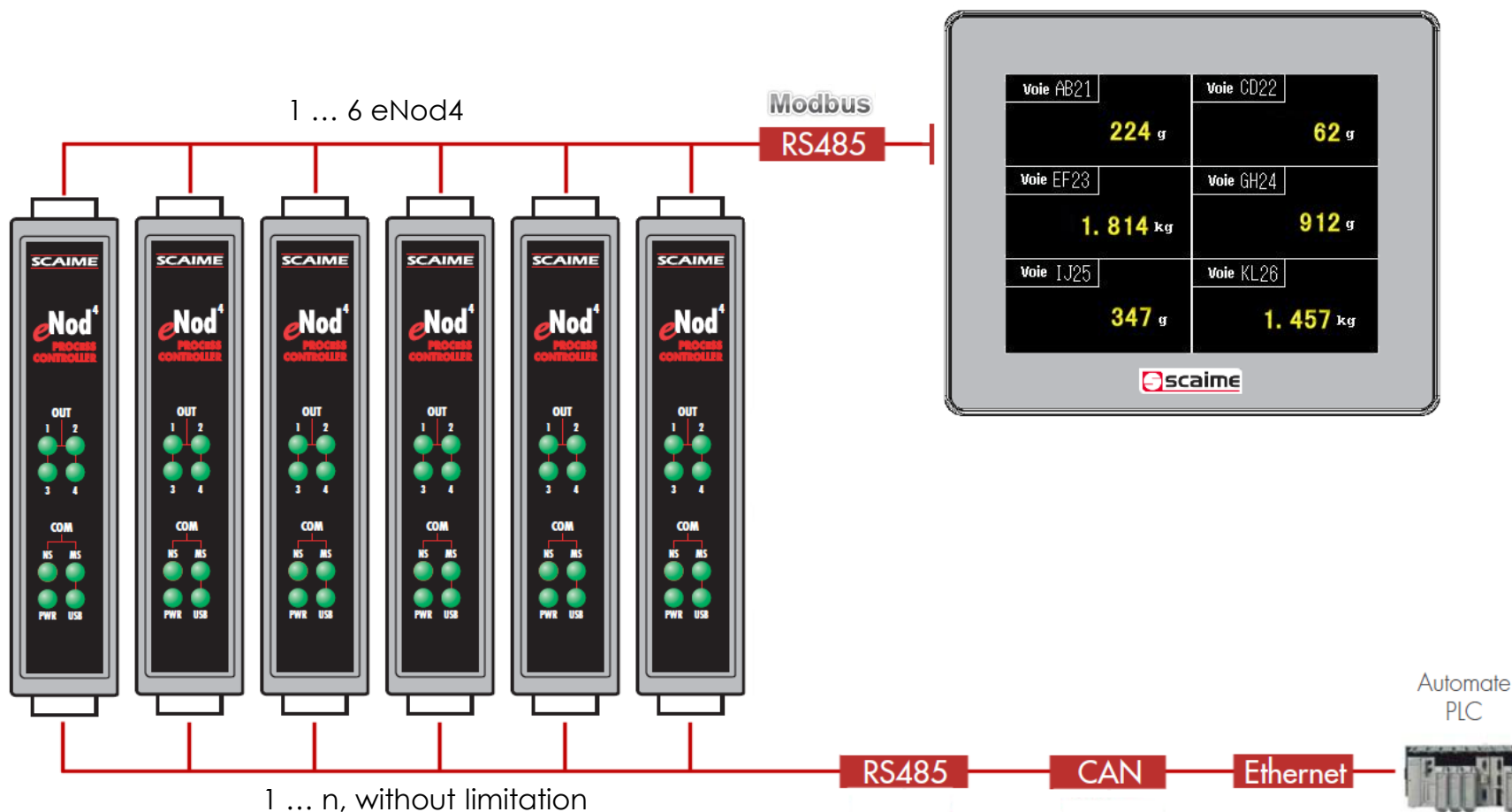
► Configuration

- I/O parameters
- Digital filters parameters
- Application parameters

Optional HMI

eNodTouch in multichannel use

- eNodTouch-MS or ML can configure and control from 1 to 6 eNod4



eNodView software

eNodView general features



► Configuration and calibration

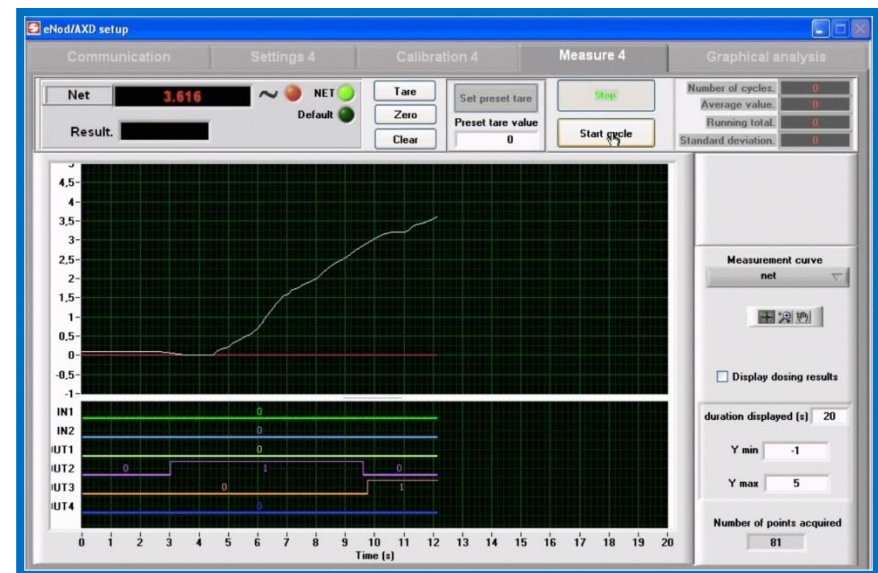
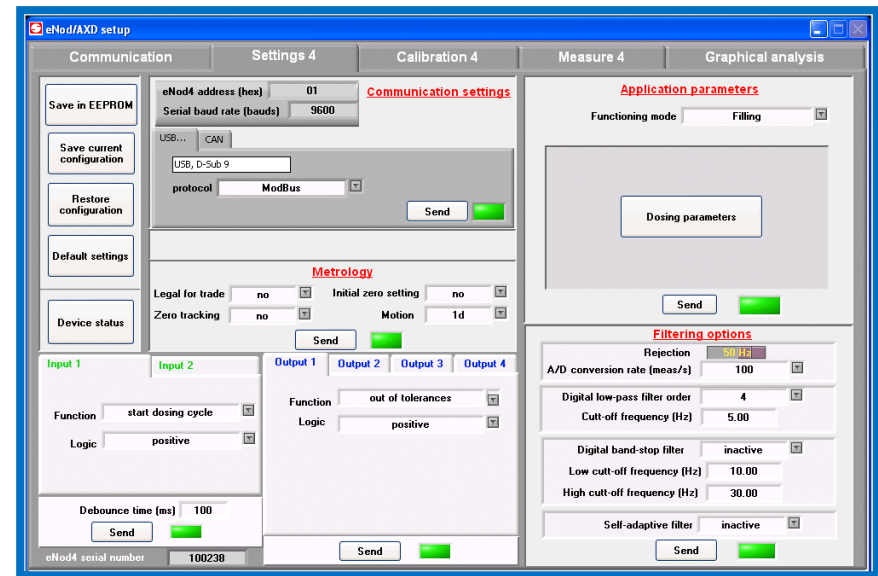
- Full access to eNod4 parameters
- Physical or theoretical calibration

► Analysis

- Acquisition and measurement display
- Frequency analysis (FFT)
- Simulation and display of filters effect

► Display

- Real time and graphical display of measurement and digital I/O

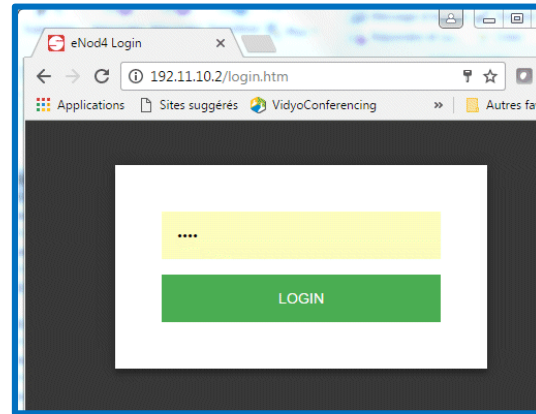


Web server

Available on all eNod4 Ethernet versions



► Administrator / User Password protected connection

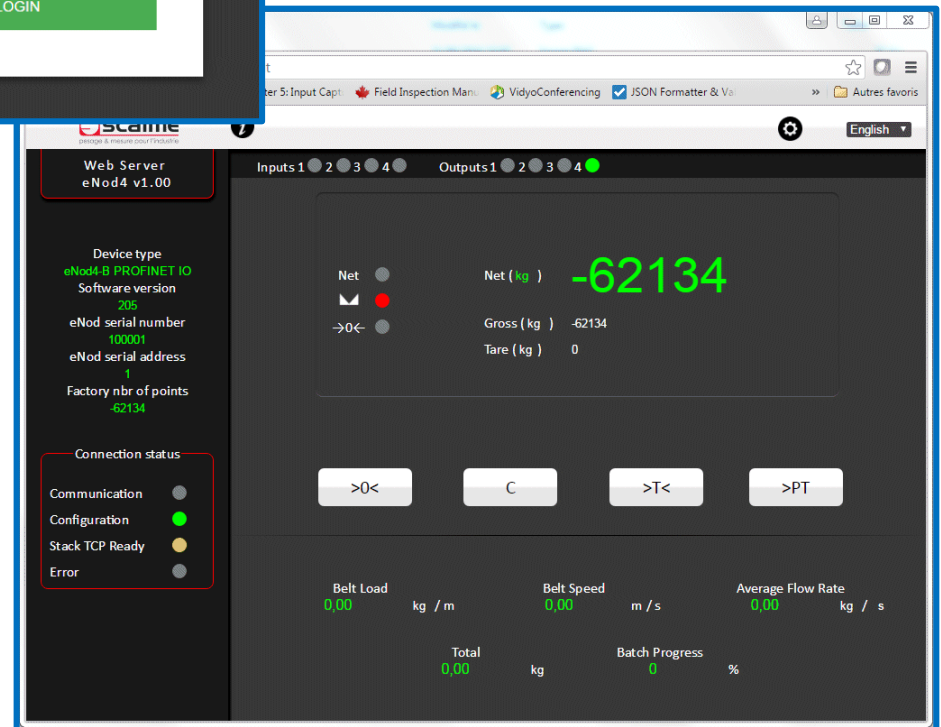


► Displaying

- Display of measurement, results and status

► Configuration and calibration

- Full access to eNod4 parameters
- Physical and theoretical calibration



Certification in Legal for trade use

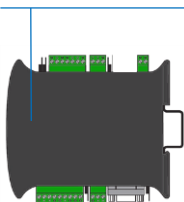
Certification according to OIML R76, R51 et R61



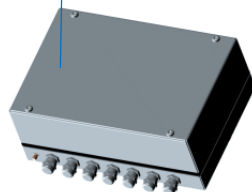
► Part certificate “Analog data processing unit”

- **eNod4-T**, according to OIML R76 for use in NAWI
- **eNod4-C**, according to OIML R51 for use in AWI catchweigher
- **eNod4-D**, according to OIML R61 for use in AWI filling machine

DIN version



BOX version without HMI

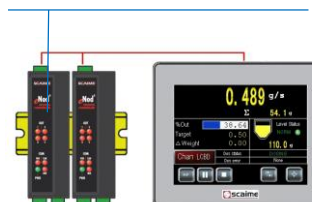


► **eNod4-T/C/D, DIN/BOX versions**

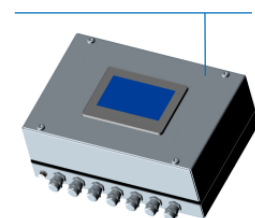
► Part certificate “Indicator” eNod4 WT

- **eNod4-T & eNodTouch**, for use in NAWI
- **eNod4-C & eNodTouch**, for use in AWI catchweigher
- **eNod4-D & eNodTouch**, for use in AWI filling machine

DIN version and eNodTouch



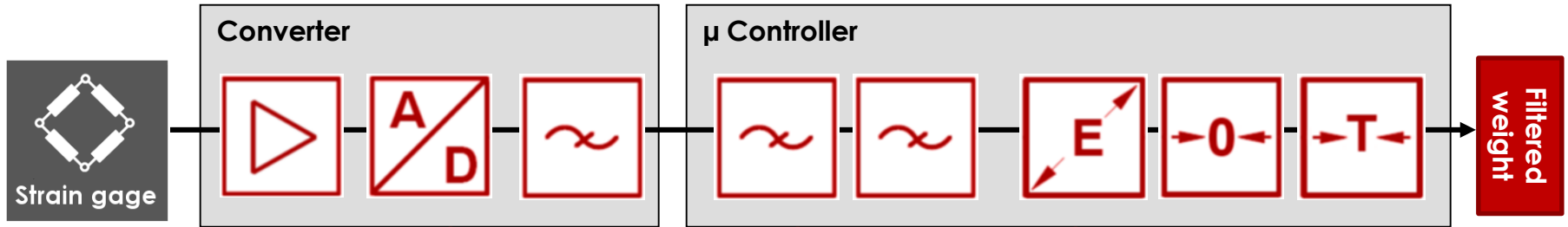
BOX version with HMI



► **eNod4 WT = eNod4 DIN/BOX + eNodTouch**

Signal processing

Conversion and filtering of load cell signal



Converter

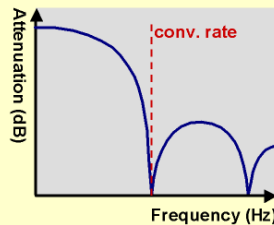
- Sensor input: $\pm 7.8 \text{ mV/V}$
- Sampling frequency **4KHz**
- Resolution **24 bits**
- Low-pass converter filter

• Conv. rate

Ver. T/C/D: **6 to 1600Hz**

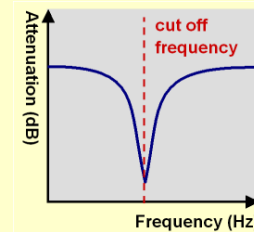
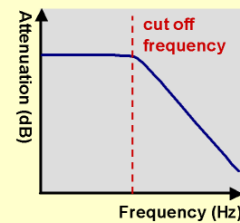
Ver. B: **400Hz**

Ver. F: **6 to 200Hz**

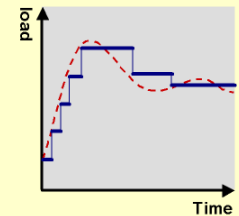


Post-Filtering

- Low-pass filter
- Notch filter



- Average (2-128), ver. B/F
- Self-adaptive, ver. T/C/D



- Scaling $\pm 500\,000 \text{ pts}$

Signal processing

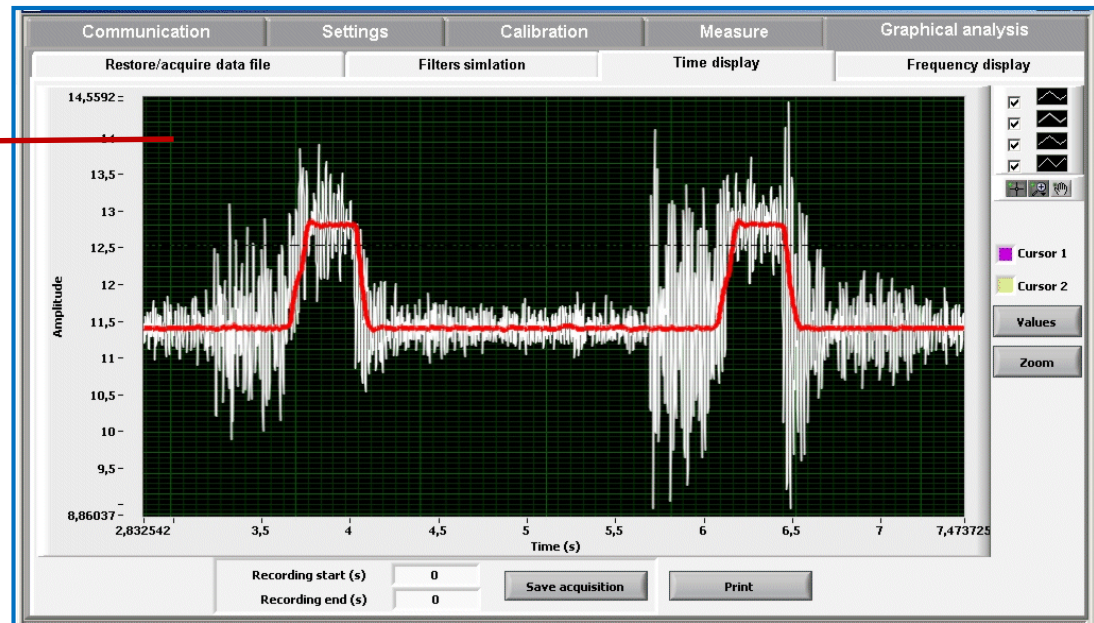
Example of digital filtering with eNod4

► On a dynamic checkweigher

- To attenuate disturbances due to vibrations, eNod4 uses several levels of digital filters.
- Digital filters adjustment can be realized with the simulation module of eNodView software.

Simulation of filters effect

In red, simulation of Low-pass filter



Weighing applications

- ▶ 3 software versions dedicated to static or dynamic weighing applications

eNod4-T
Transmitter



eNod4-D
Dosing



eNod4-C
Checkweigher



eNod4-B
Belt weighing



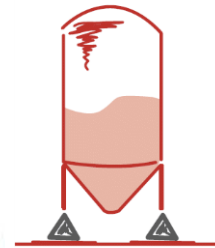
eNod4-F
Continuous feeder



- ▶ 2 software versions dedicated to continuous weighing applications



eNod4-T, weighing transmitter

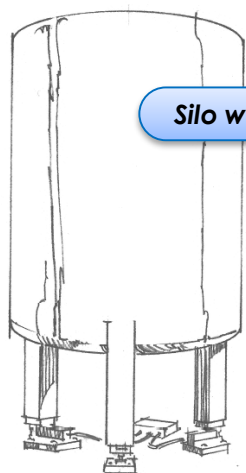


eNod4-T weighing transmitter

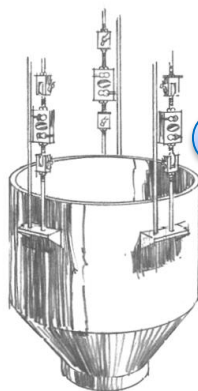
eNod4
applications

Weighing solution from 1kg to 1000t...

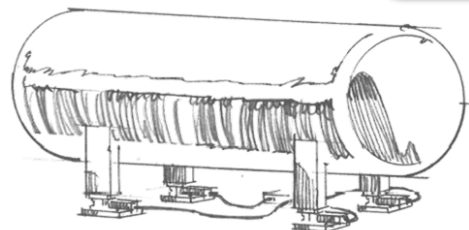
- ▶ eNod4 in combination with our range of load cells and mounting hardware
- ▶ Ideally suitable for conveyors, hoppers, tanks or silos weighing



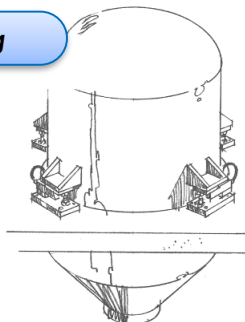
Silo weighing



Hopper weighing



Tank weighing



Conveyor weighing



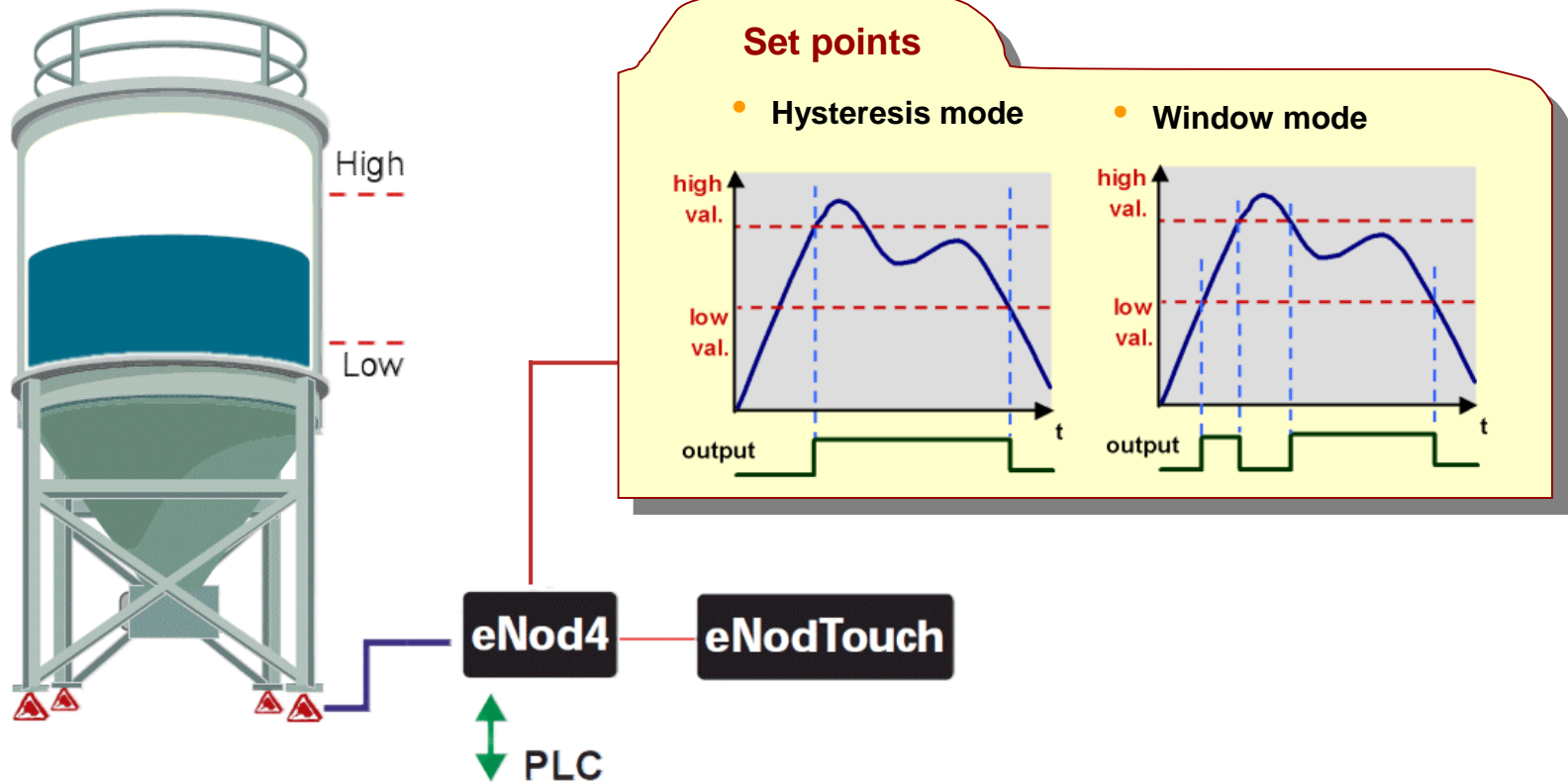
eNod4-T weighing transmitter

eNod4
applications

High speed and high accuracy measurement transmission

► Functionalities

- Physical or theoretical weighing calibration
- Measurement scaling, decimal point and unit management
- Up to 4 set points management



eNod4-T Weighing transmitter

eNod4
applications

Application case

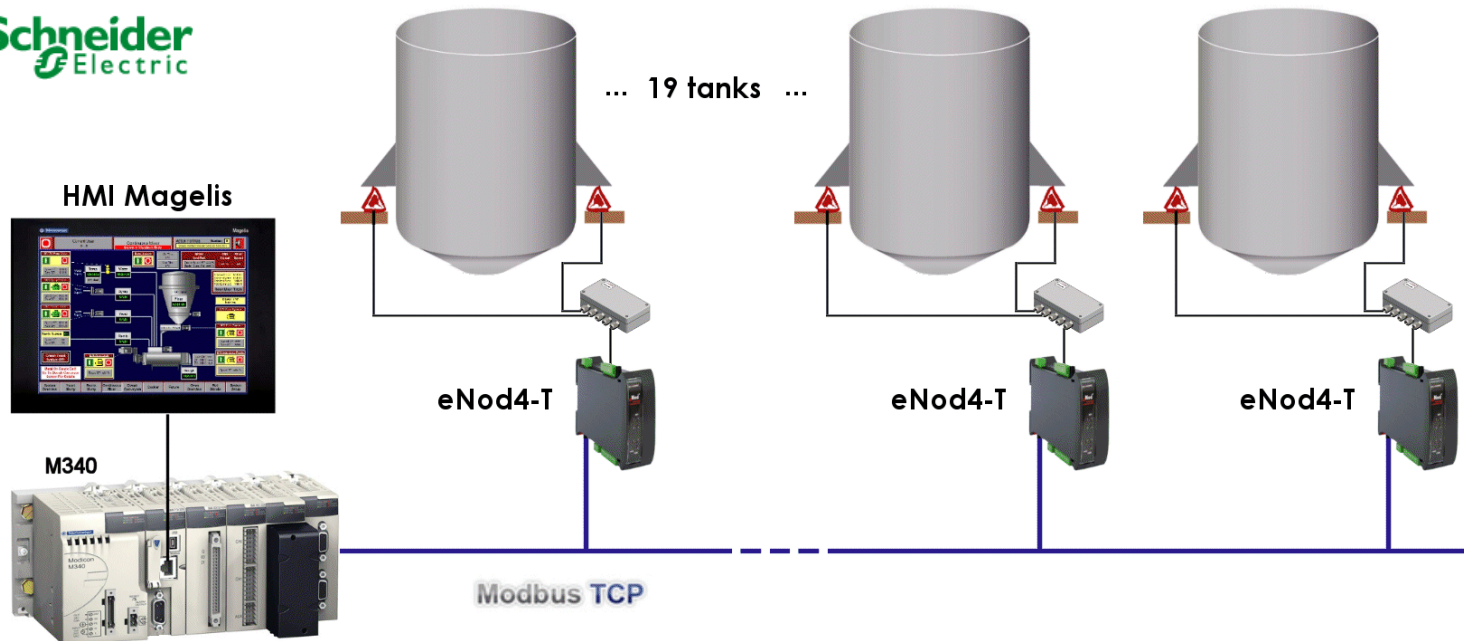
► Tanks level monitoring

- Weighing all the tanks of the production unit
- Realization in partnership with Schneider Electric
- **effective Ethernet architecture for easy data access between the automated system and the ERP system.**

 syngenta

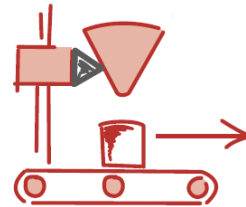


Collaborative Automation
by
 Schneider
Electric





eNod4-D, Dosing and filling

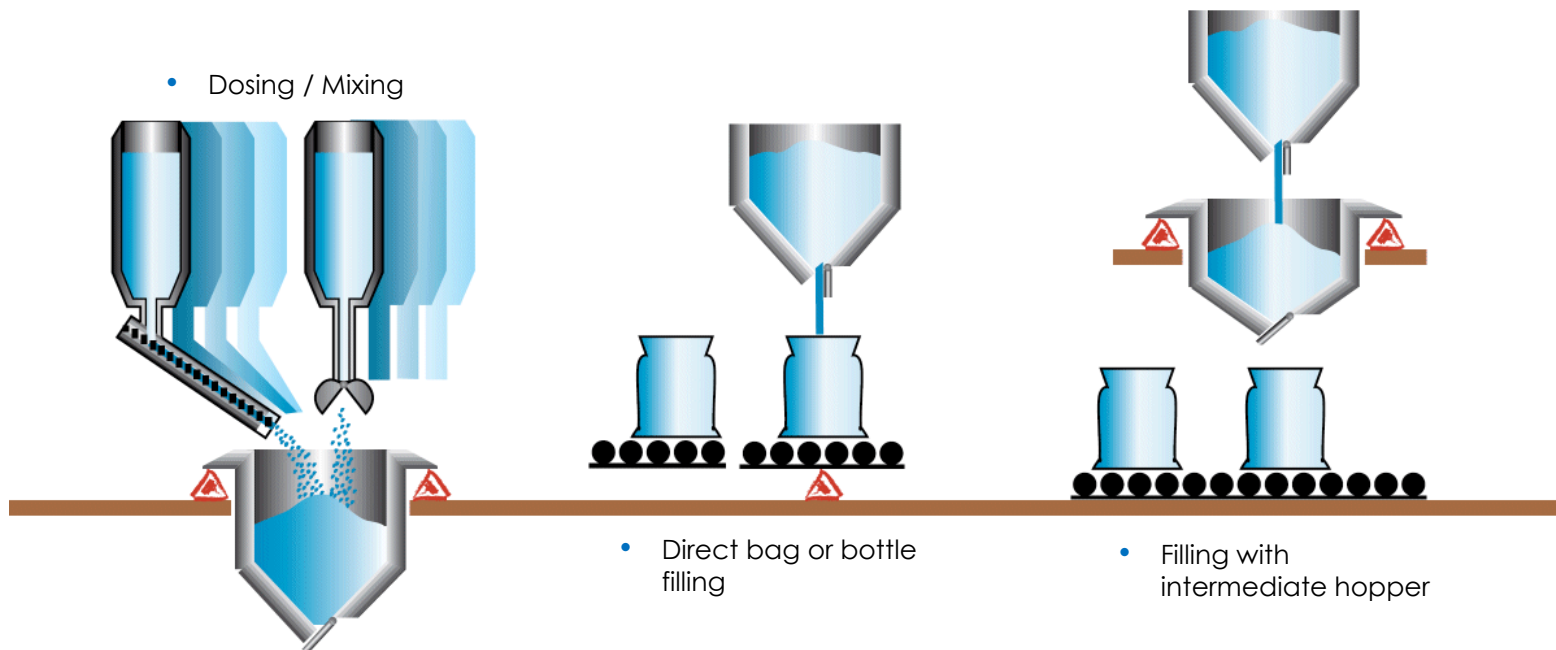


eNod4-D Dosing and filling

eNod4
applications

Solution for all batch dosing of filling processes

- ▶ Fully management of a single product dosing cycle, by filling or by unloading
- ▶ Allows you to design complex multi-product dosing systems, without limit of products number.
- ▶ Suitable for high speed filling in noisy environments.
- ▶ Can be used both connected to a PLC or in autonomous with dedicated HMI.
- ▶ Software for configuration, Filters simulation and dosing cycle monitoring



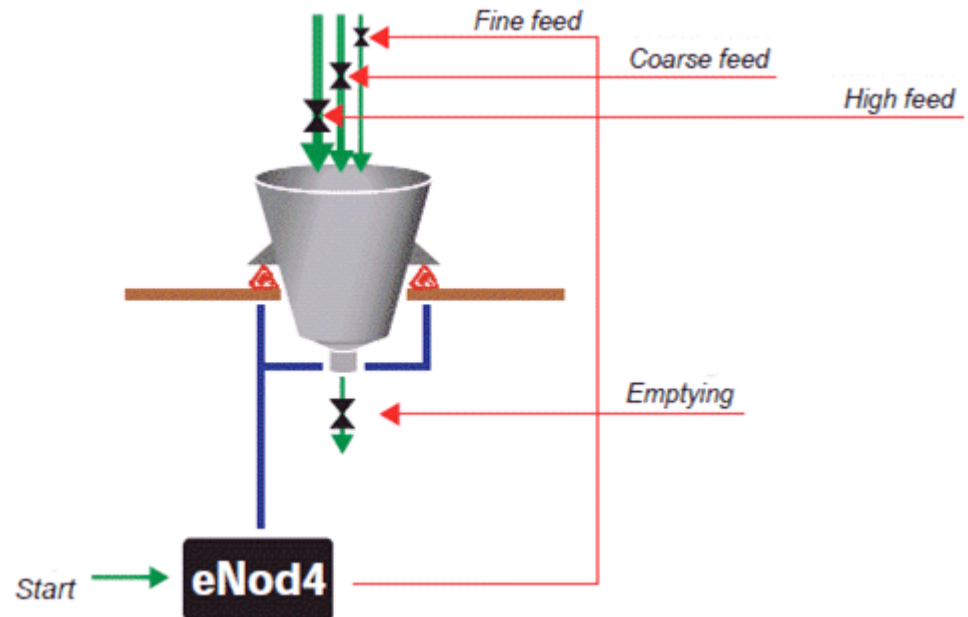
eNod4-D Dosing and filling

eNod4
applications

Filling processes management

► Filling Functionalities

- Takes in charge a full mono-product filling cycle
- Control of 1, 2 or 3 filling feeds, configurable feed sequences (CF, CF-FF, HF-CF-FF, FF-CF-FF)
- « Dynamic » functioning mode for accurate dosing without weight stability (Rotating dosing machines)
- Emptying management (or ejection), Manual or automatic
- Filling tolerance control
- Automatic or fixed in-flight correction
- Automatic or manual start
- Tare presence control



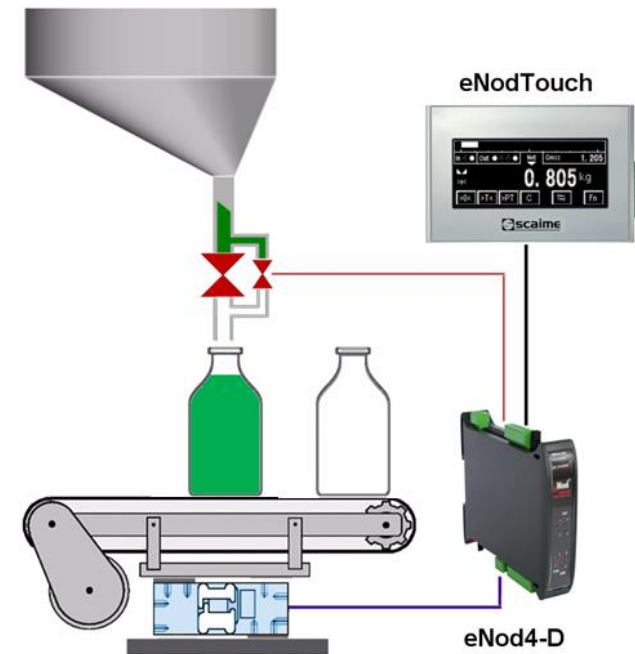
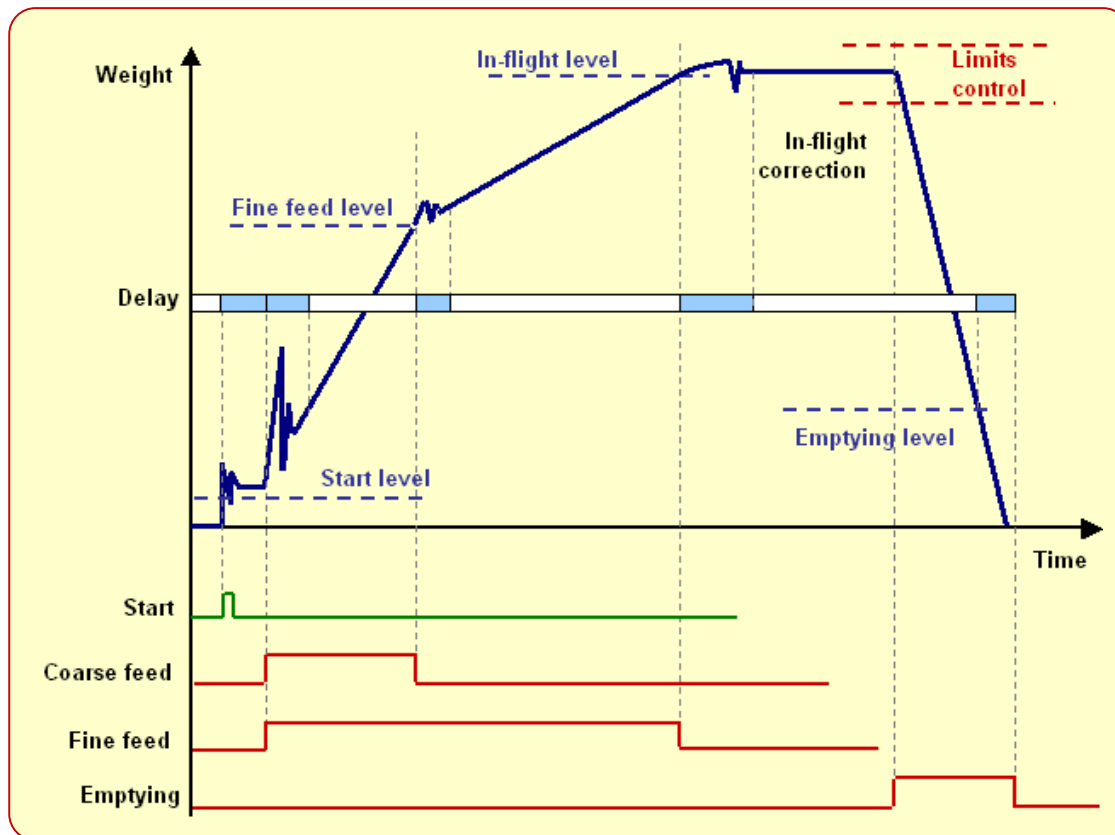
eNod4-D Dosing and filling

eNod4
applications

Filling processes management

► Example of 2-feed filling cycle

- Configurable weigh level as starting cycle condition
- Adjustable measurement neutralization time at each step of the dosing cycle



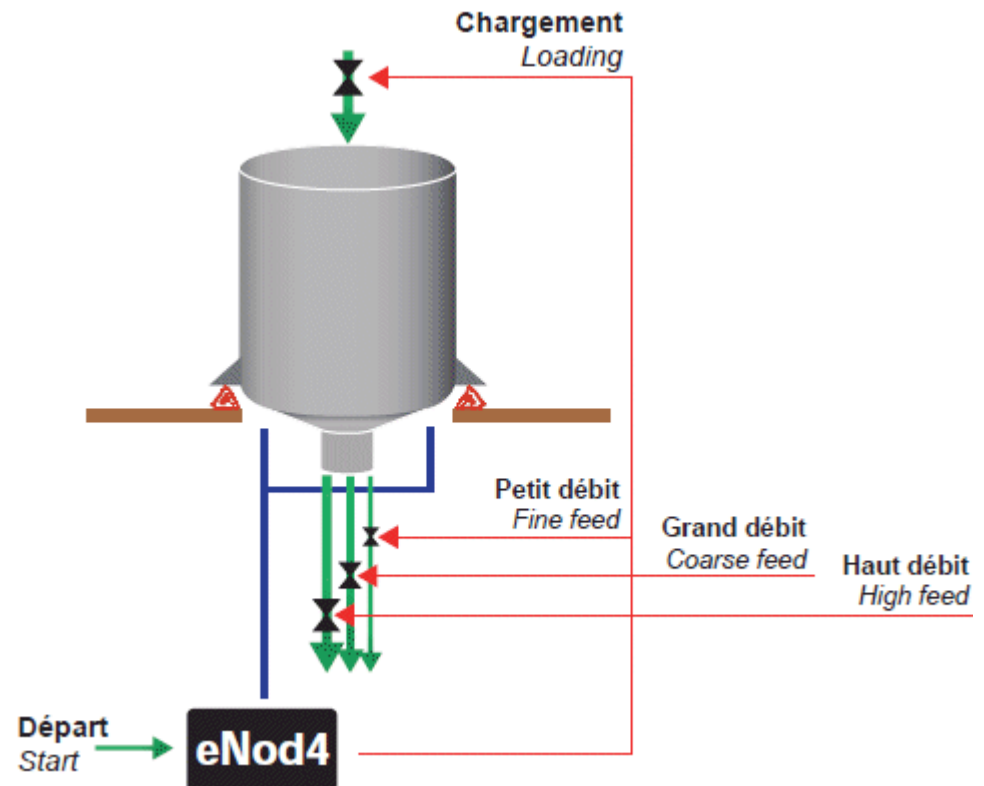
eNod4-D Dosing and filling

eNod4
applications

Dosing by unloading management

► Unloading Functionalities

- Control of 1, 2 or 3 filling feeds
- Configurable feed sequences (CF, CF-FF, HF-CF-FF, FF-CF-FF)
- Reloading management, at the end or beginning of the cycle
- Dosing tolerance control
- Automatic or fixed in-flight correction



eNod4-D Dosing and filling

eNod4
applications

eNodView functionalities with eNod4-D

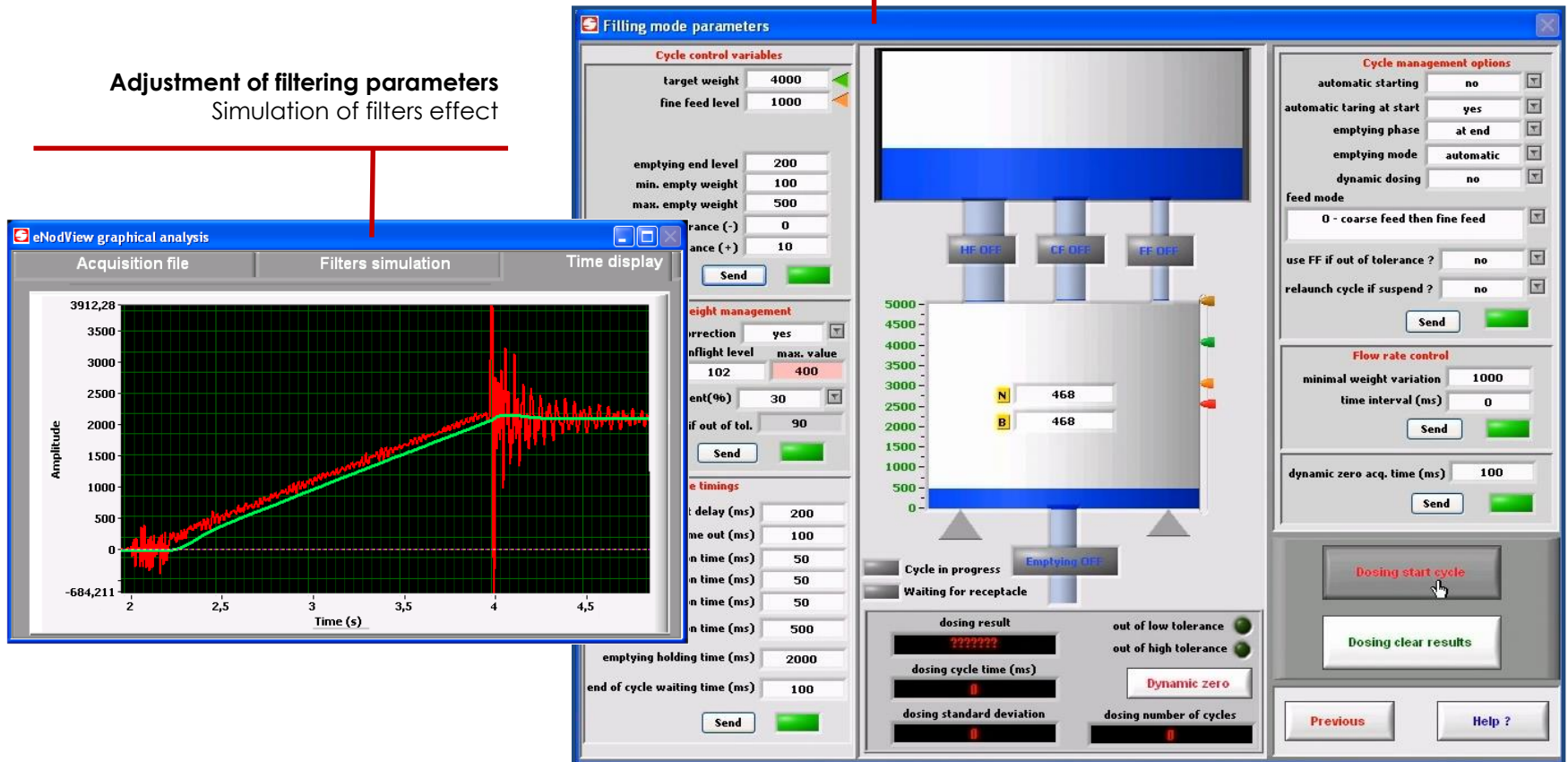
► Screenshot of eNodView software

Setting of dosing parameters

Real time supervision of dosing cycle

Adjustment of filtering parameters

Simulation of filters effect



eNod4-D Dosing and filling

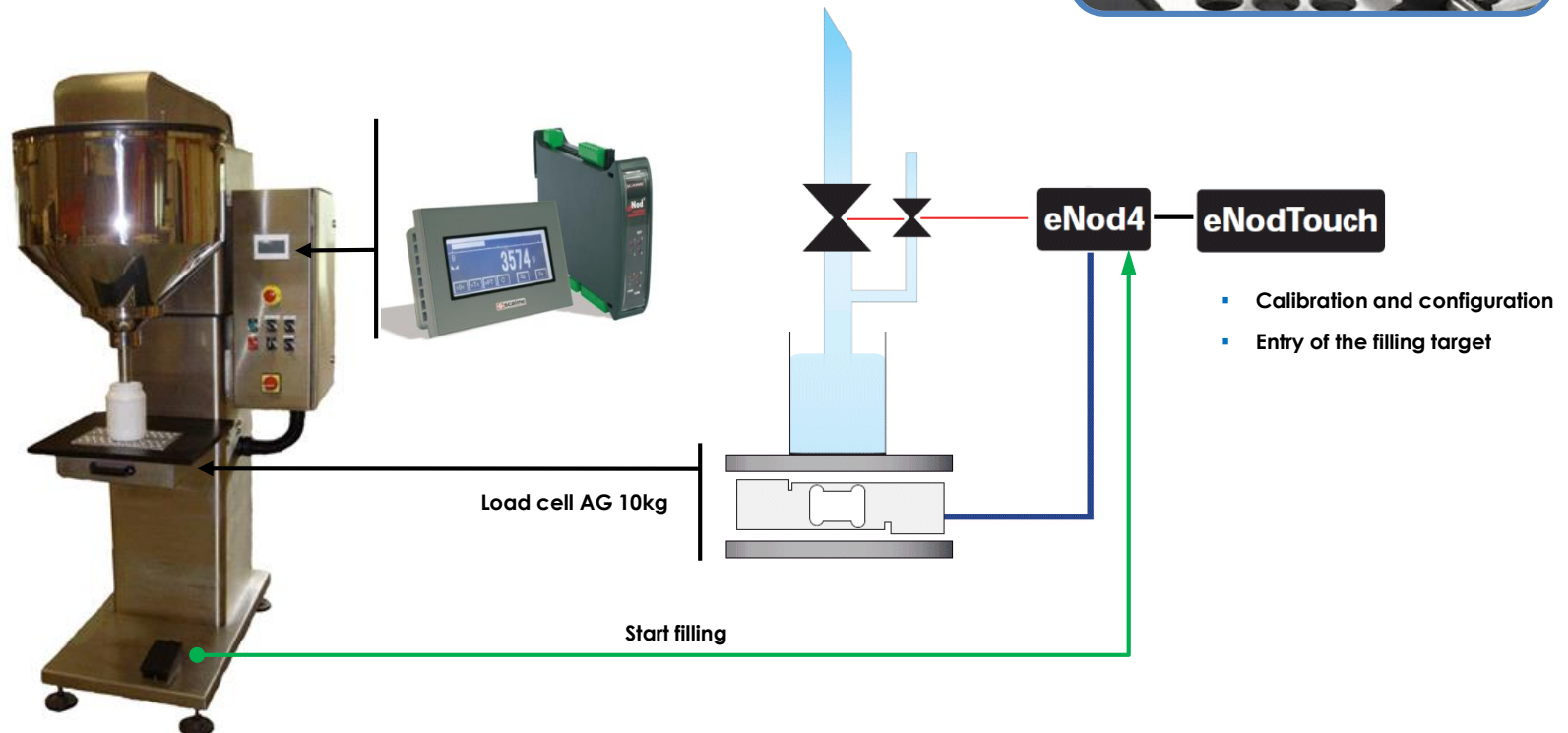
eNod4
applications

Application case

► Simple filling machine

- Filling machine of spices pots
- The machine is controlled by eNod4 and eNodTouch, without PLC use.
- **fast, accurate and economical solution**

SERIN



eNod4-D Dosing and filling

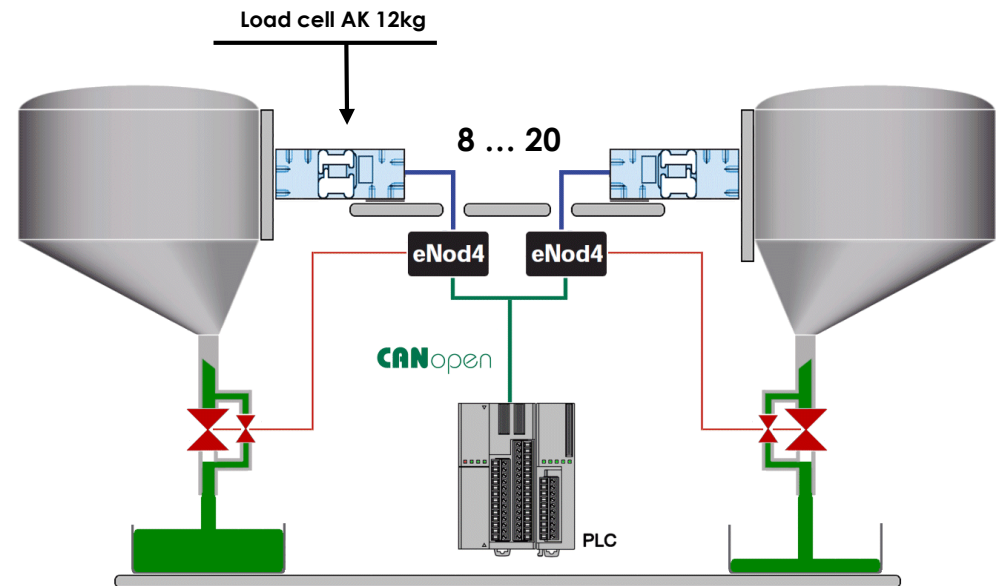
eNod4
applications

Application case

► Multi-head rotary filler

- 8 to 20 heads rotary machine for sauce filling.
- The PLC takes in charge the overall control of the machine.
- The eNod4-D control the filling process for optimal accuracy and maximum production rate.

SOLSIN
PROCESS & PACKAGING



eNod4-D Dosing and filling

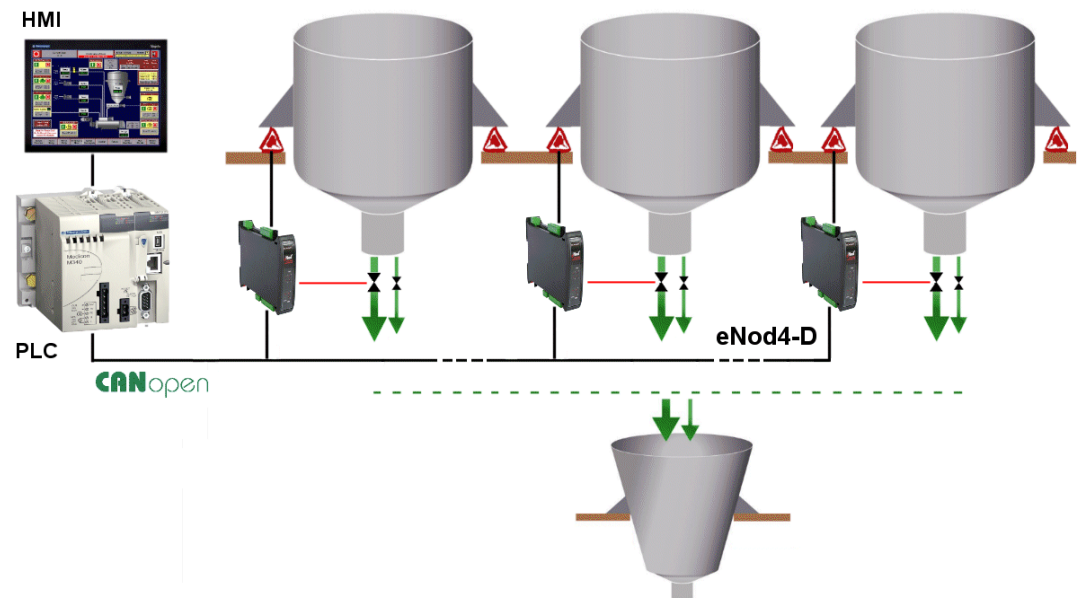
eNod4
applications

Application case



► Multi-product mixing by unloading

- Mixing of 3 products for candy production line.
- **The PLC handles recipes management** and the sequencing of successive dosing
- With parameters coming from PLC, **the enod4-D take in charge the dosing cycle** of each product.
- **With this architecture, elements perform the tasks for which they are most efficient.**



eNod4-D Dosing and filling

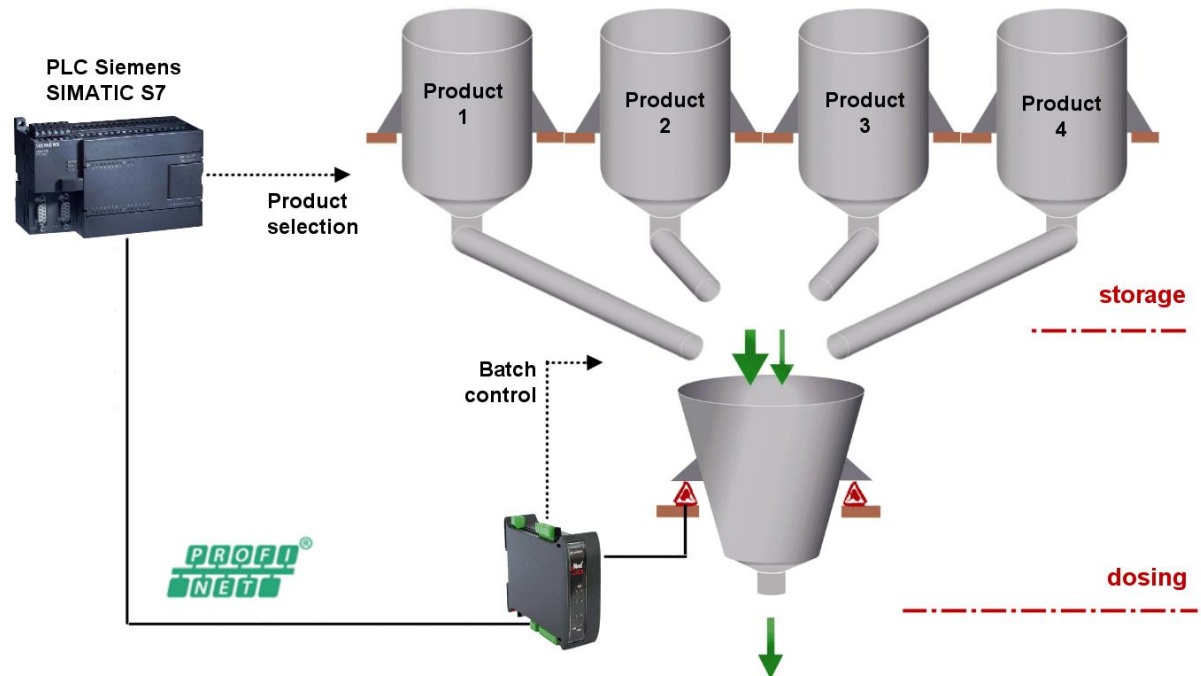
eNod4
applications

Application case



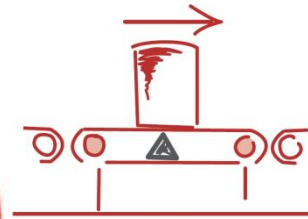
► Multi-product filling for mixing

- Mixing of 4 products for plastic production line.
- The PLC handles **recipes management**, the **product selection** for dosing and the **sequencing of successive dosing**.
- With parameters coming from PLC, the **enod4-D** take in charge the **dosing cycle** of each product and the final emptying.





eNod4-C, Checkweighing and grading

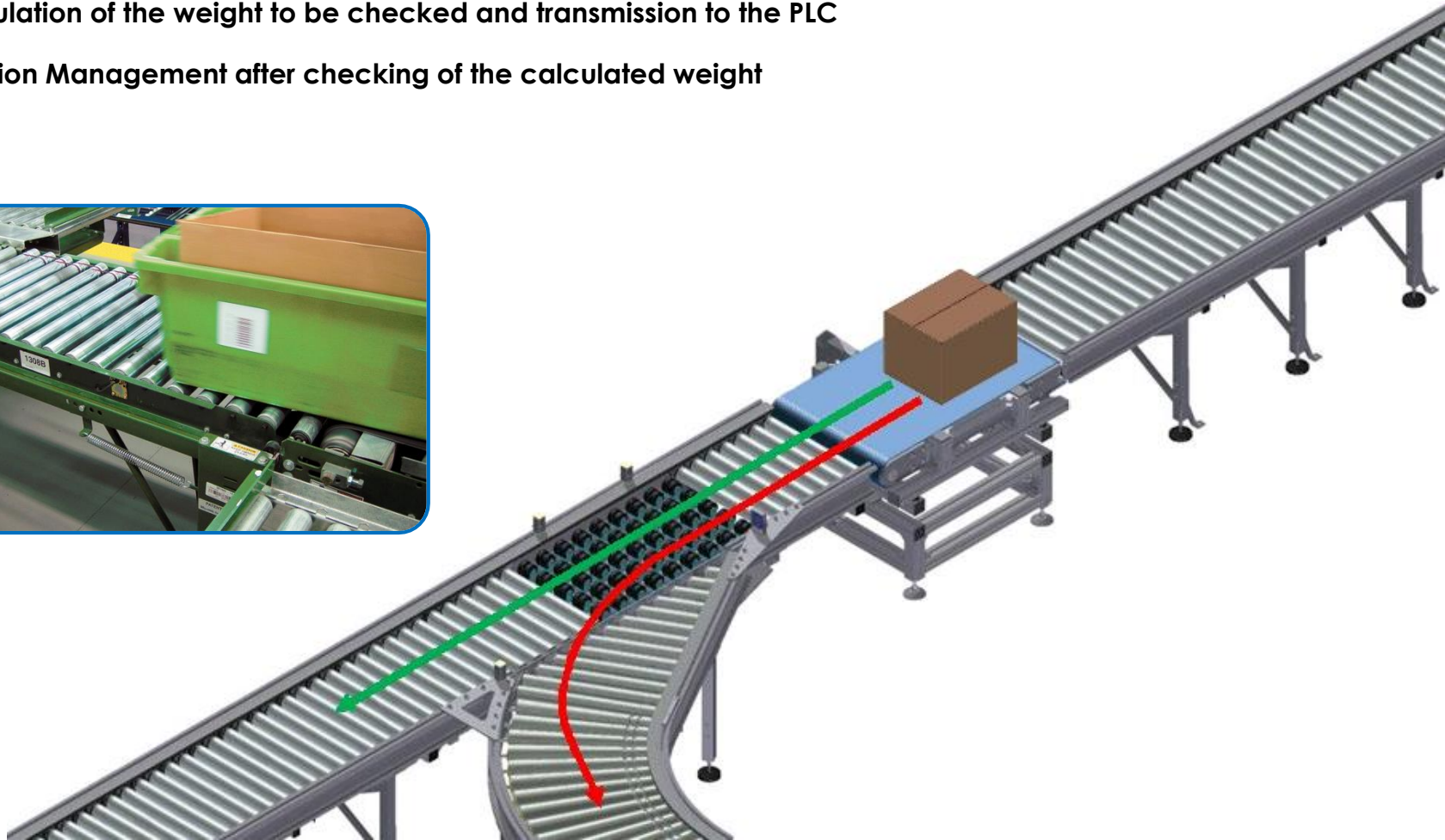


eNod4-C, Checkweighing and grading

eNod4
applications

Checkweighing functionalities

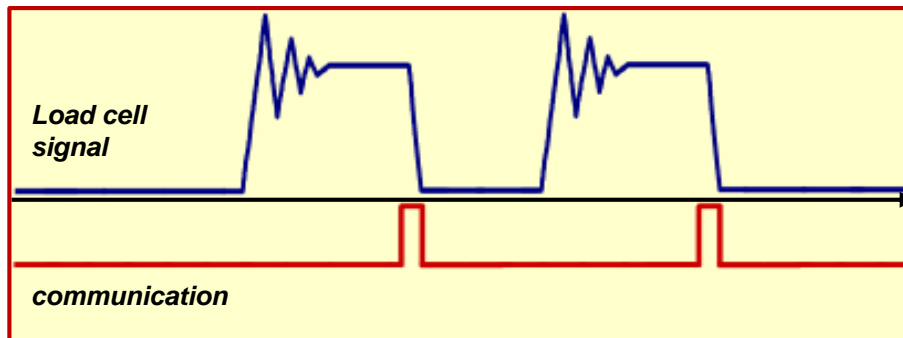
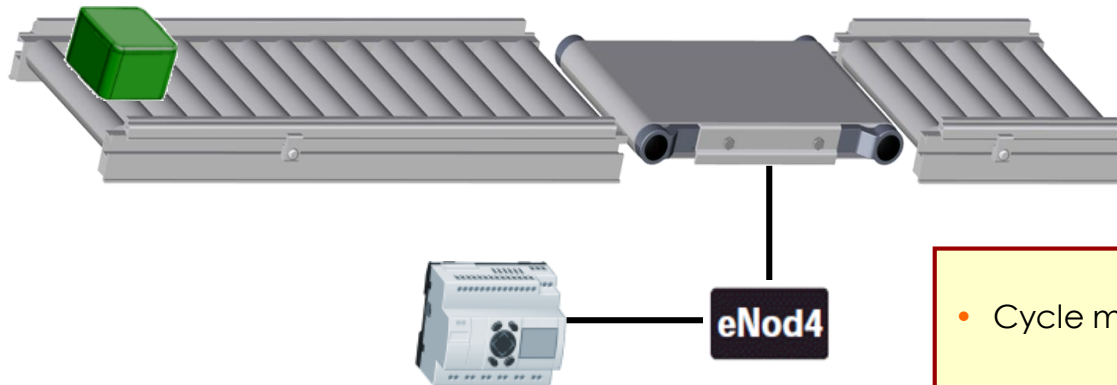
- ▶ Takes in charge a full cycle of dynamic checkweighing
- ▶ Presence detection of an element to be checked by weight level or detector
- ▶ calculation of the weight to be checked and transmission to the PLC
- ▶ Ejection Management after checking of the calculated weight



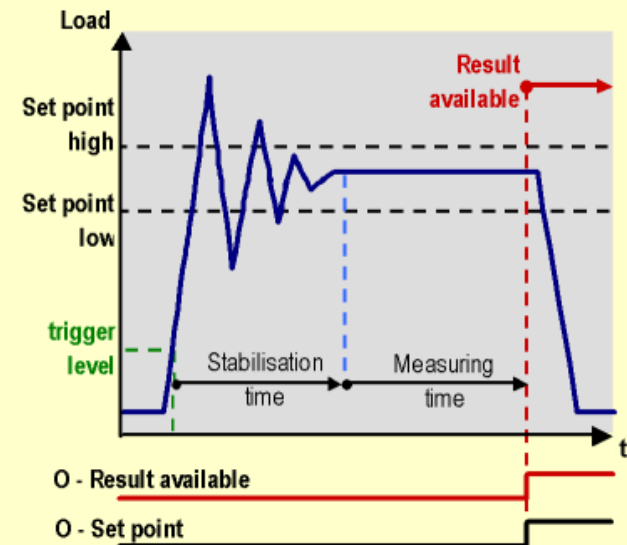
eNod4-C, Checkweighing and grading

eNod4
applications

Internal triggering par weight level



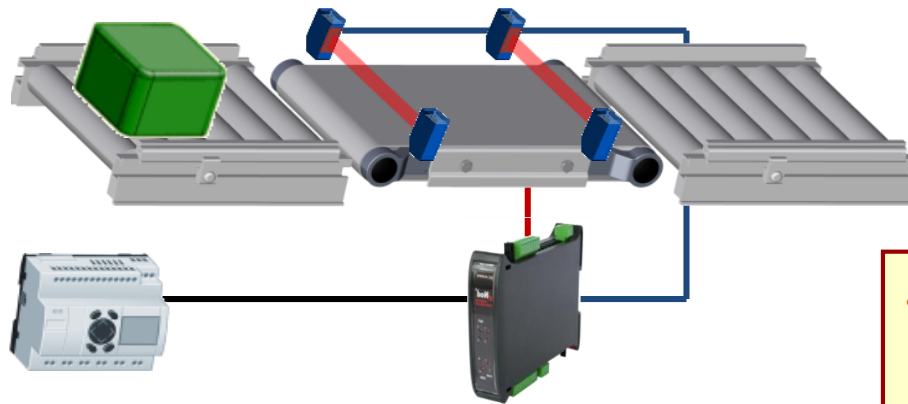
- Cycle management without detector



eNod4-C, Checkweighing and grading

eNod4
applications

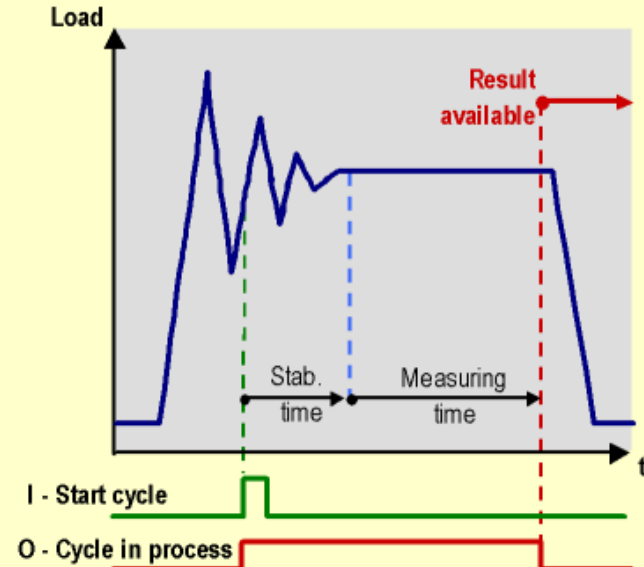
External triggering by 1 or 2 detectors



► Ejection management

- Target weight & tolerances (+ and -) management
- Ejection or routing management for out of tolerance or within tolerances items
- Delay and activation time of the ejection output
- Up to five items may be stored between the weighing location and the ejection location.

• Cycle management with 1 detector



eNod4-C, Checkweighing and grading

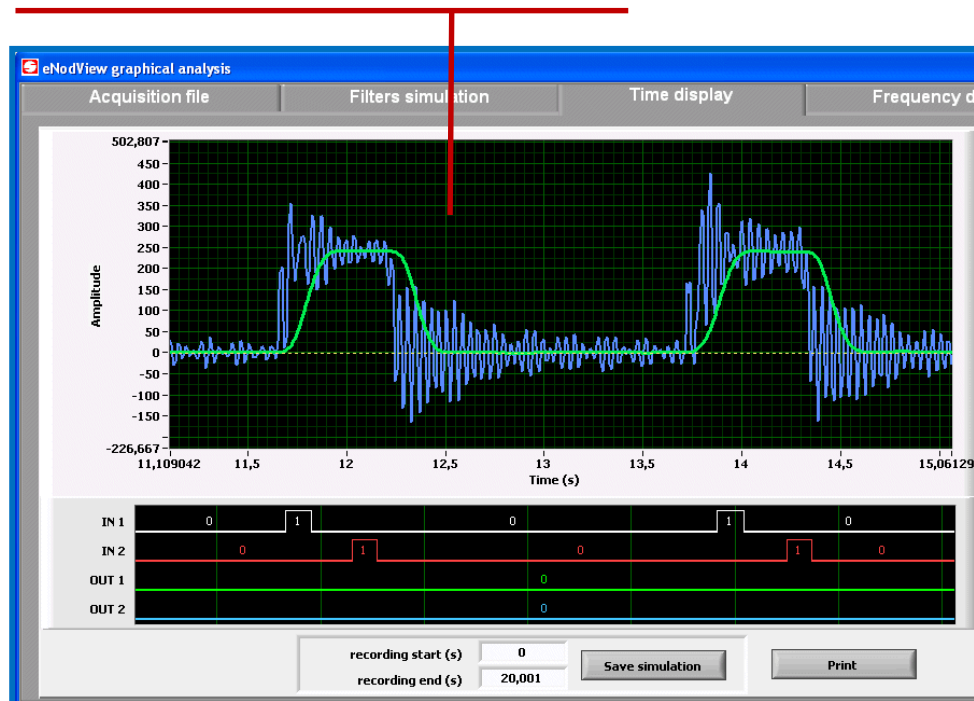
eNod4
applications

eNodView functionalities with eNod4-C

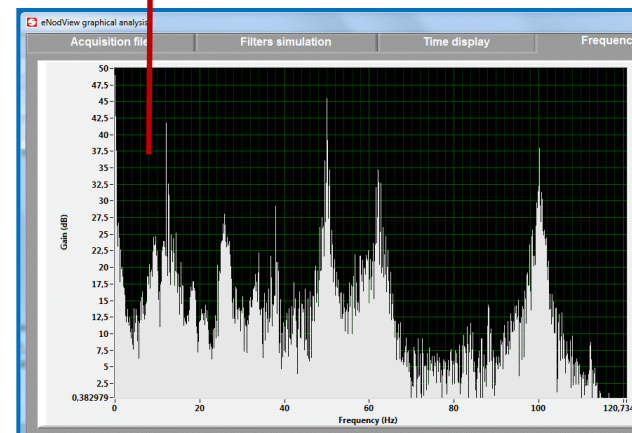
- eNod4 digital filters adjustment for vibration attenuation

Filter adjustment by simulation

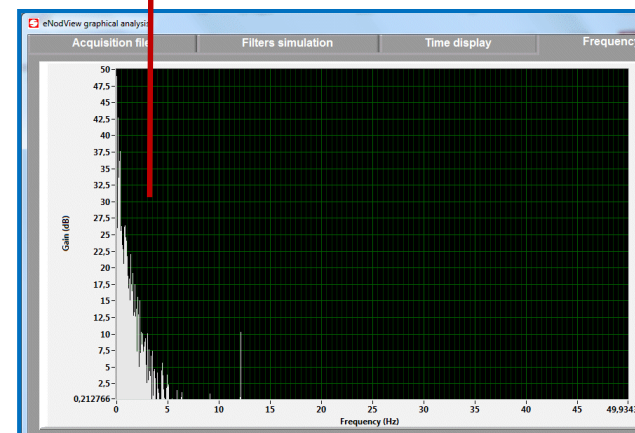
In green, Simulation of filters effect on signal



Signal frequency analysis Without filters



Signal frequency analysis With simulated filters

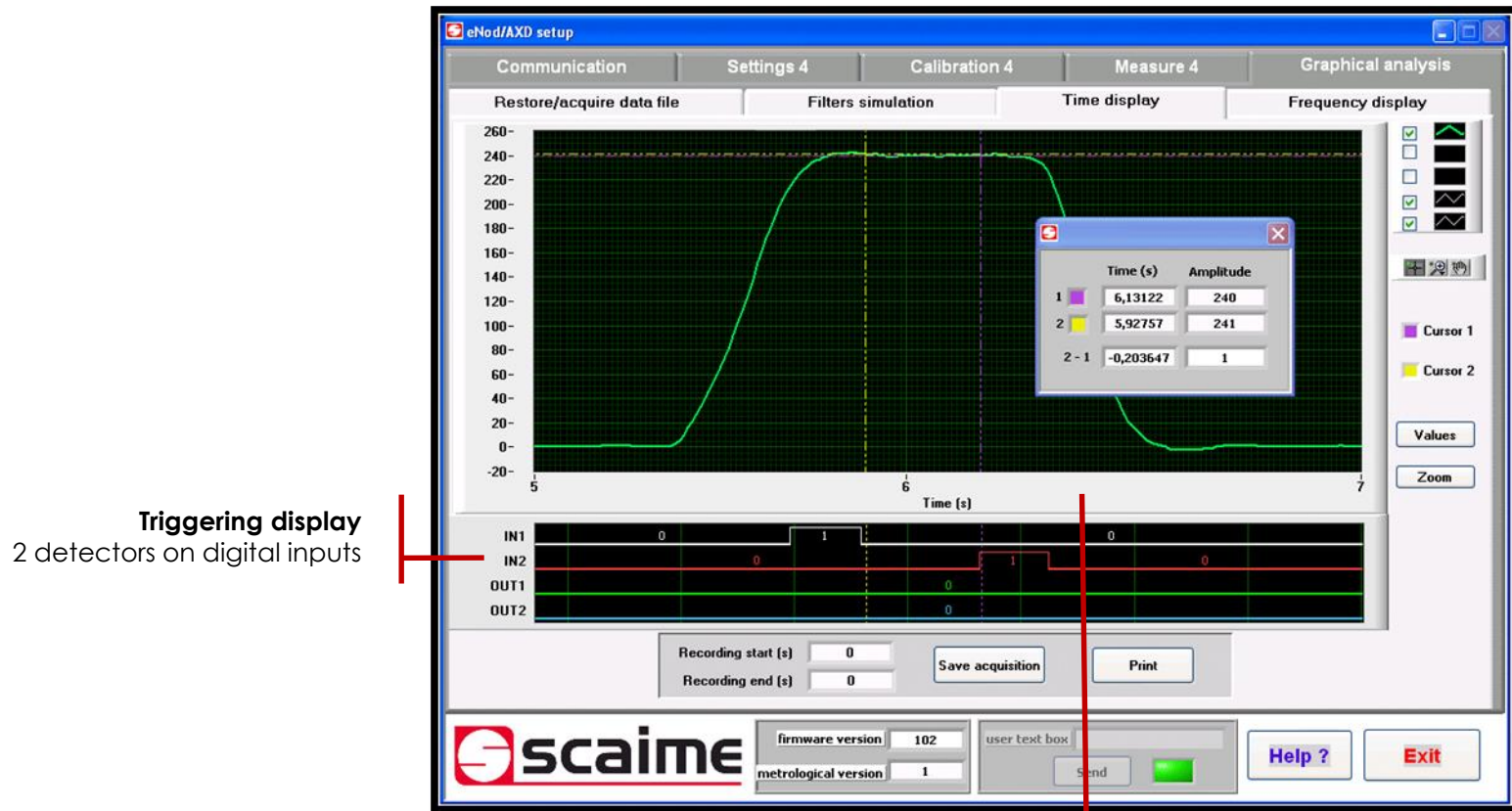


eNod4-C, Checkweighing and grading

eNod4
applications

eNodView functionalities with eNod4-C

- time adjustment of dynamic weighing cycle



Triggering display
2 detectors on digital inputs

Setting of checkweighing parameters
Adjustment of triggering and measurement time

eNod4-C, Checkweighing and grading

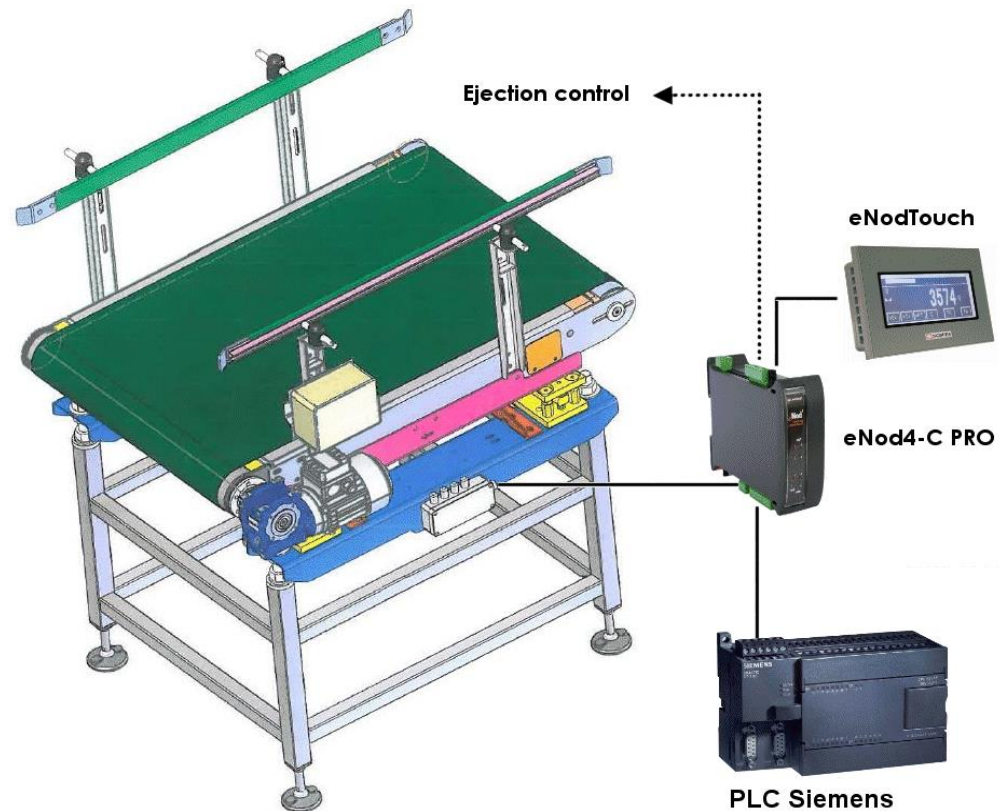
eNod4
applications

Application case

► weight barrels control

- This system allows the control of barrels production at the end of line: Incomplete containers are automatically ejected by eNod4-C.
- Checking rate of 120 containers / min with an accuracy of ± 5 g.

GREIF



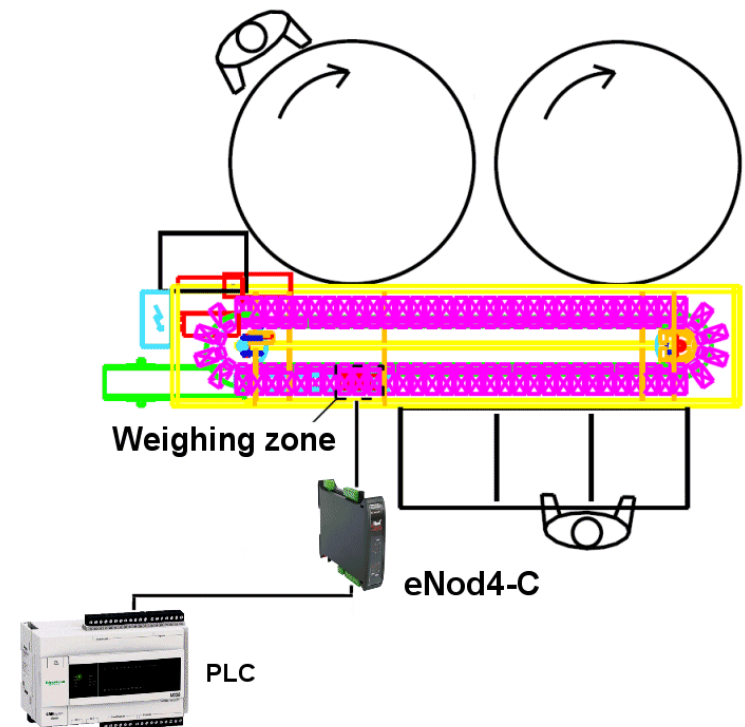
eNod4-C, Checkweighing and grading

eNod4
applications

Application case

► Fruits grading machine

- eNod4-C takes in charge fruit weight calculation and transmission to the PLC
- The PLC takes in charge fruit ejection according to its weight.
- **With this architecture, the machine reaches a rate of 12 fruits / s.**





eNod4-B, Belt scale & belt weigh feeder

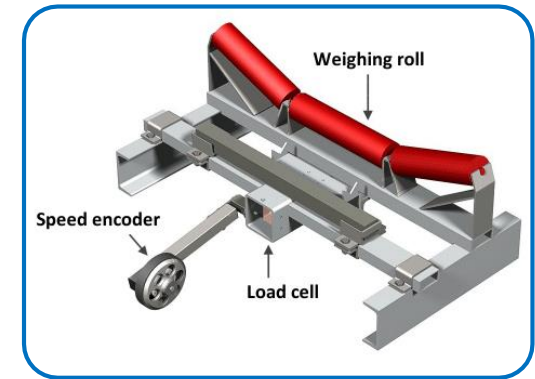
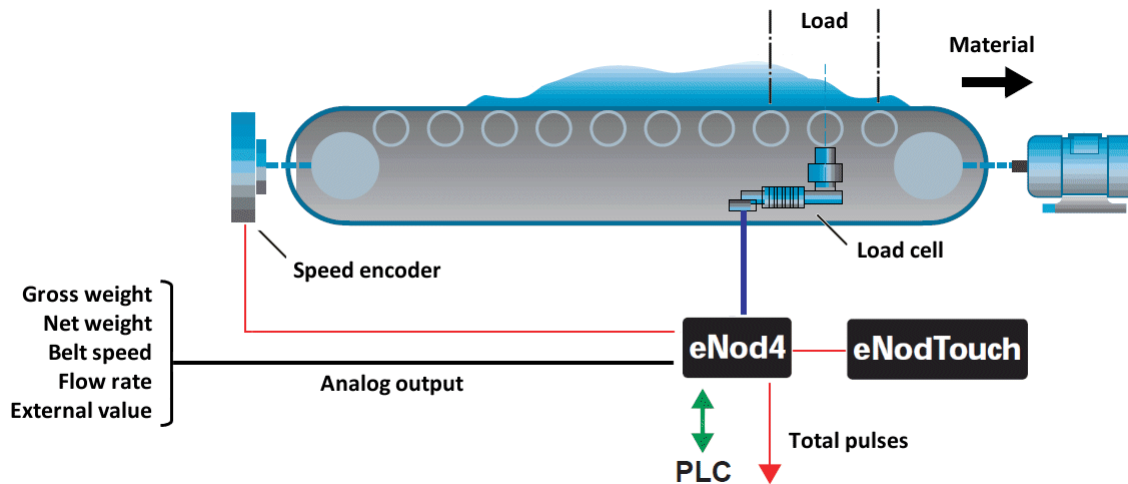


eNod4-B, Belt scale & belt weigh feeder

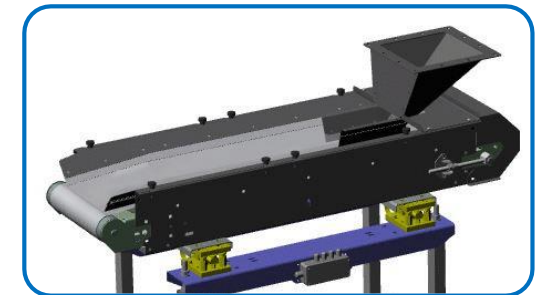
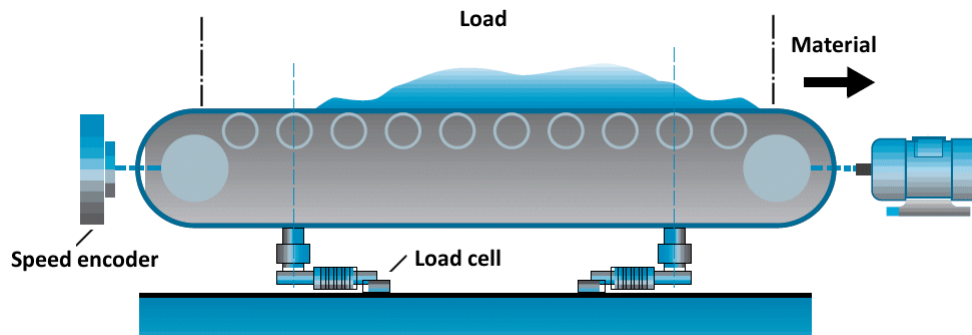
eNod4
applications

Belt scale management

► Weighing of belt section (long conveyor)



► Weighing of complete conveyor (short conveyor)



eNod4-B, Belt scale & belt weigh feeder

eNod4
applications

Totalizing on belt scale

► Configuration

- Physical or theoretical weight calibration
- Fixed or measured belt speed (speed encoder)
- Flow rate calibration by correction of totalized weight
- Configurable flow rate unit: g/s, g/h, kg/s, kg/h, t/h
- Correction coefficient of belt inclination

► Functionalities

- Flow calculation and continuous weight totalizing, with 3 independent and stored levels of total.
- Dynamic zero of belt scale
- Belt speed calculation
- Weight integration per unit of length
- Pulse output for external Totalizer
- Configurable analog output
- Loading cycle management with target on total and inflight correction

► Main alarms and controls

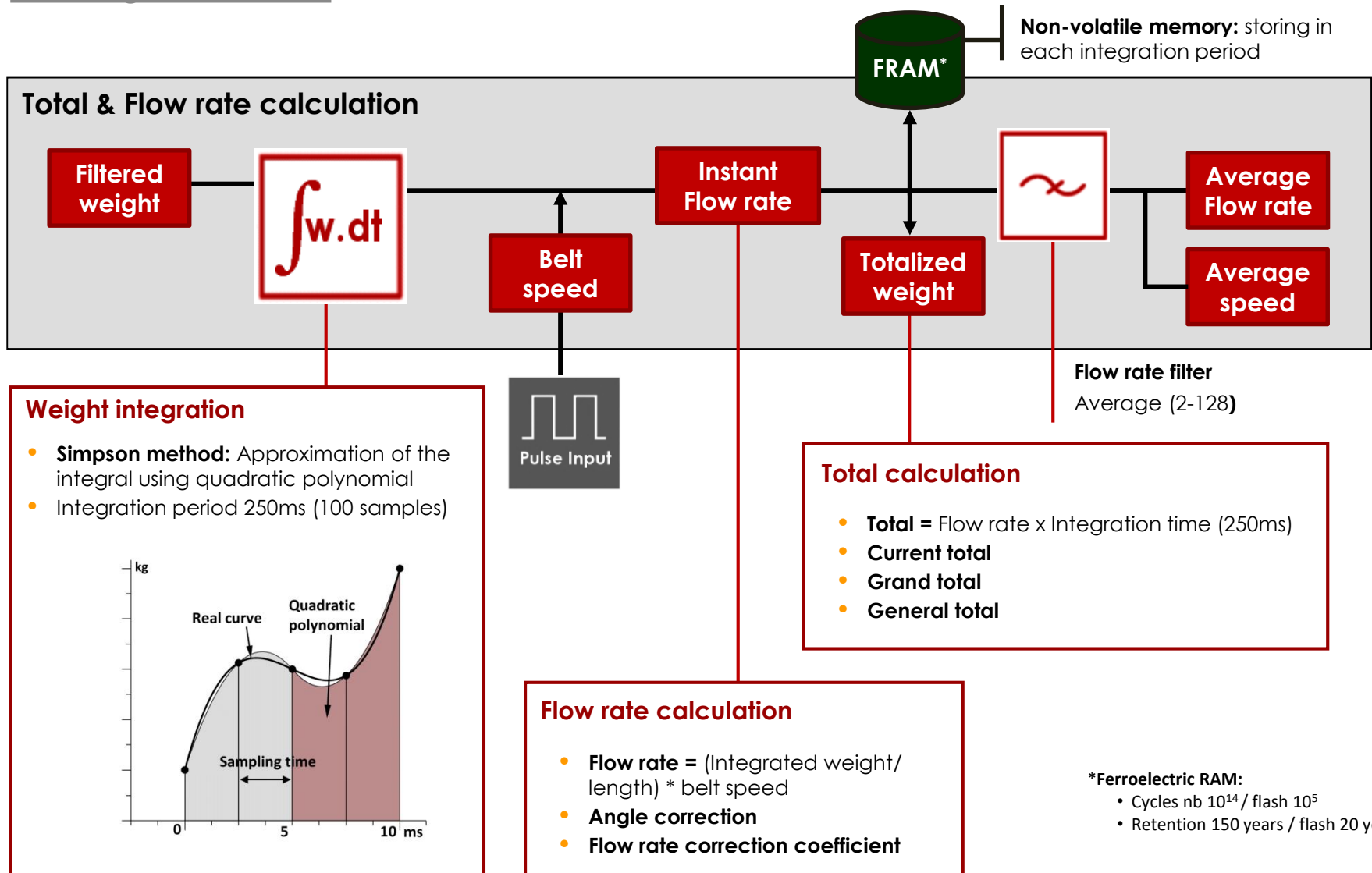
- Min / Max flow rate, Min/Max belt speed, Min/Max belt load, Band start warning



eNod4-B, Belt scale & belt weigh feeder

eNod4
applications

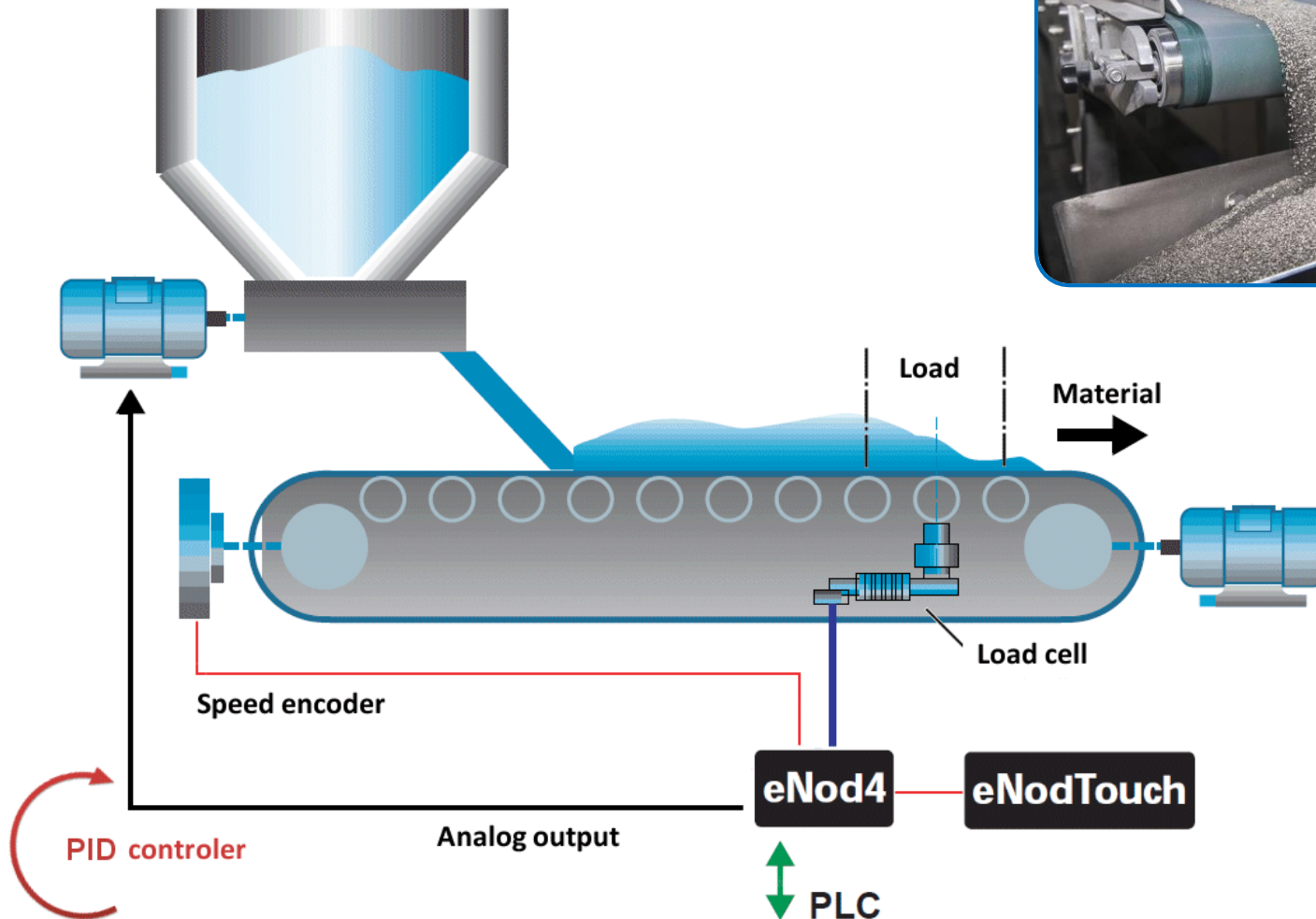
Totalizing on belt scale



eNod4-B, Belt scale & belt weigh feeder

eNod4
applications

Flow rate control on belt weigh feeder



eNod4-B, Belt scale & belt weigh feeder

eNod4
applications

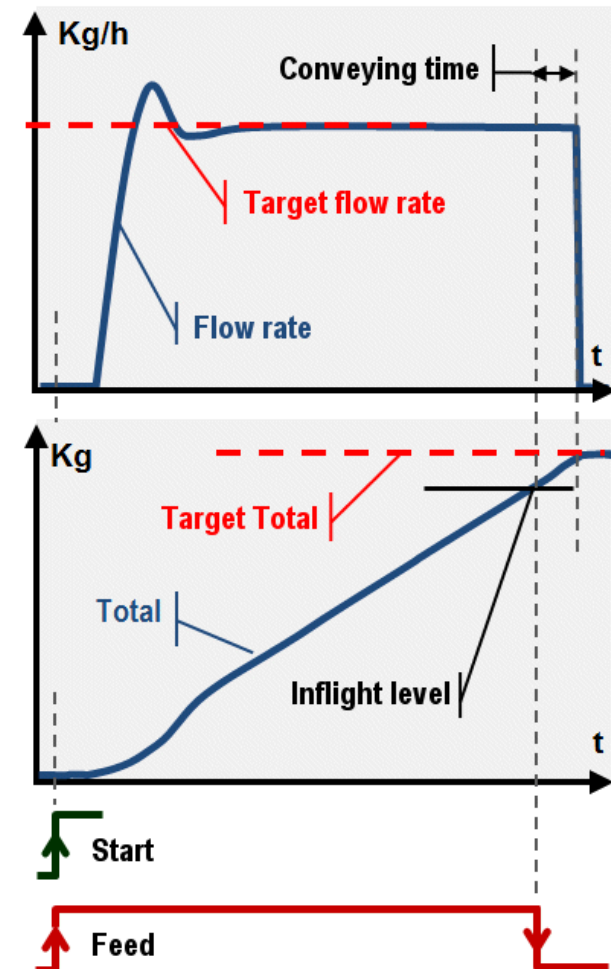
Flow rate control on belt weigh feeder

► Configuration

- **Management of Target flow rate and Target total**
- **Control output setting** (Analog output): Calibration in flow rate, possibility of remote control by external value
- **Adjustment of PID controller parameters** : Manual or automatic self-adjustment

► Functionalities

- **Flow rate regulation by in-built PID controller with action on belt speed or material supply.**
- Limits management of control output
- **Loading cycle management with target on total and inflight correction**

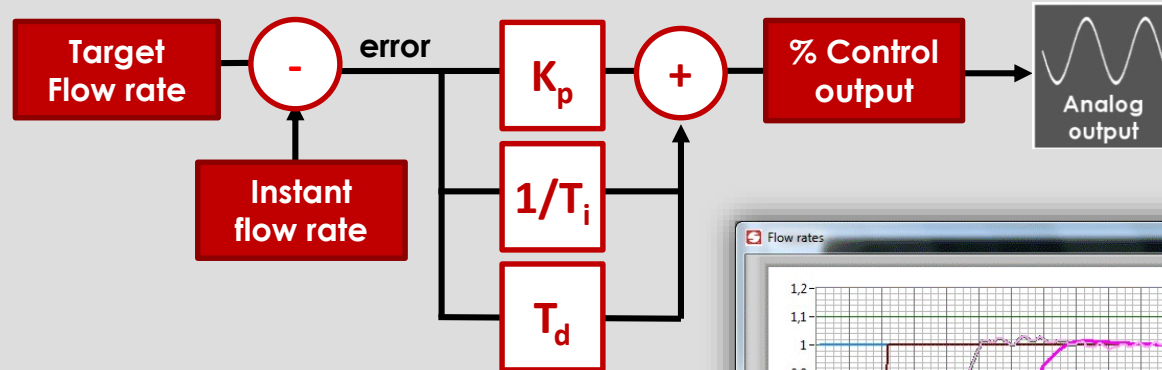


eNod4-B, Belt scale & belt weigh feeder

eNod4
applications

Setting of PID controller with eNod4 & eNodView

PID controller – Proportional – Integral – Derivative

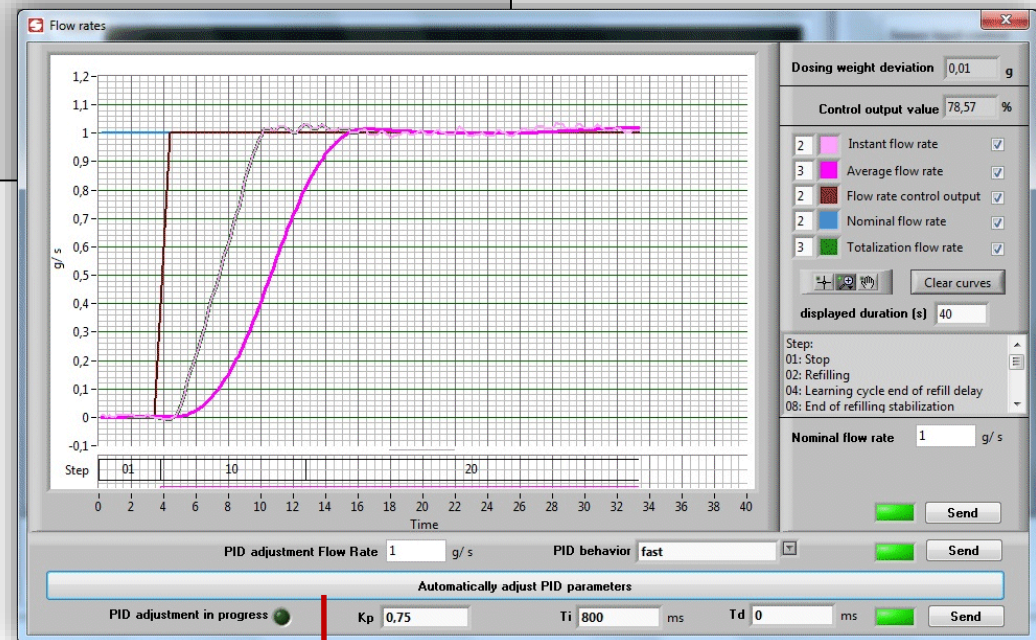


► Manual

- eNodView allows setting of PID parameters (K_p , T_i , T_d) by graphic display of the step response.

► Automatic

- Self-adjustment of PID parameters using Bröida model.
- Choice of 2 behavior for PID : Fast / Stable.



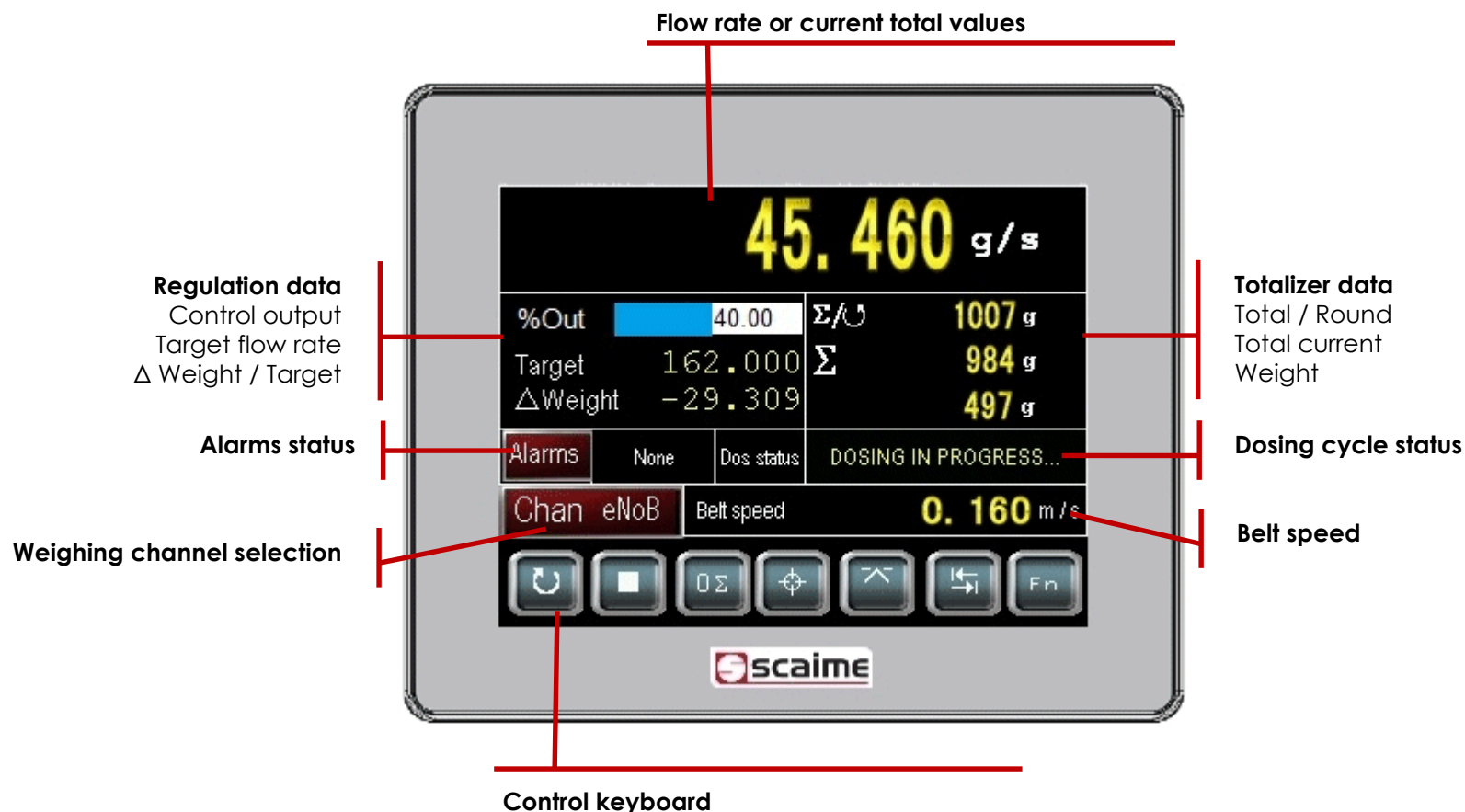
Automatic adjustment of PID parameters

eNod4-B, Belt scale & belt weigh feeder

eNod4
applications

eNodTouch Functionalities with eNod4-B

► eNodTouch-M or ML main screen



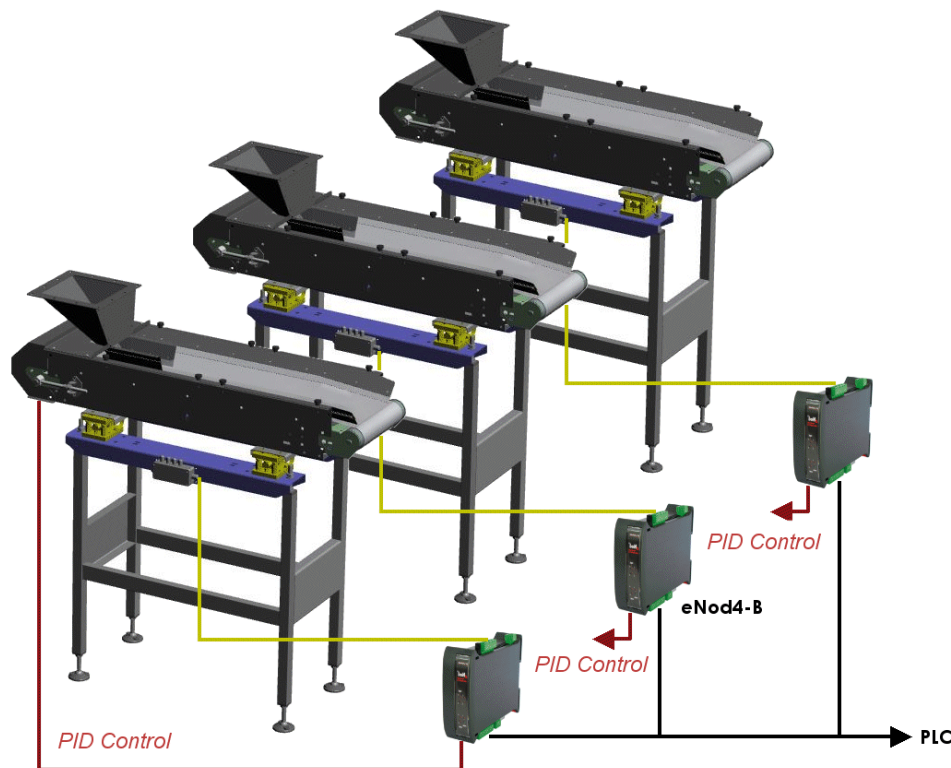
eNod4-B Belt scale & belt weigh feeder

eNod4
applications

Application case

► Continuous mixing of 3 products with flow rate regulation

- The PLC handles the management of mixing formulas
- With the parameters transmitted by the PLC, 3 eNod4 take in charge of the belt feeders, the weight totalization and flow rate regulation.





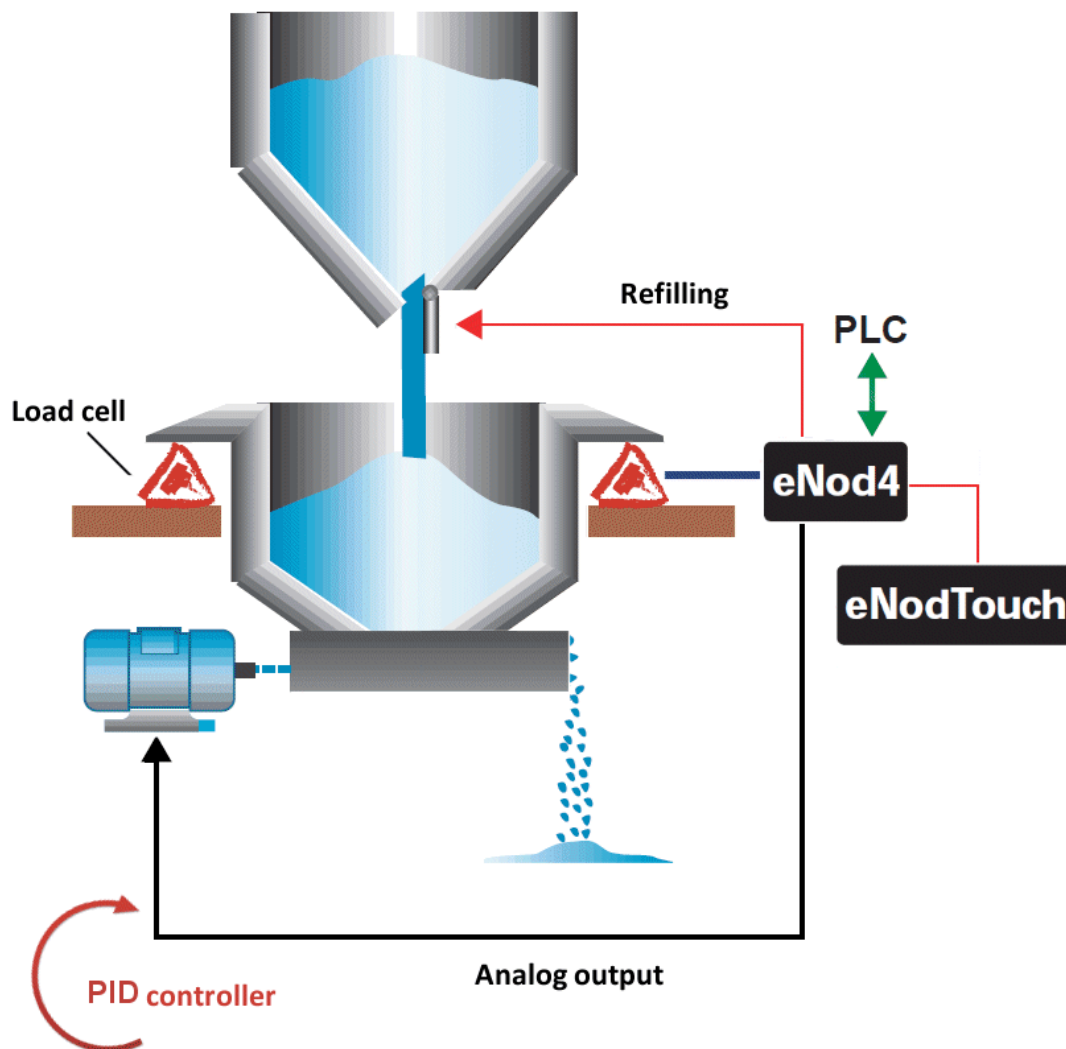
eNod4-F, Continuous feeding



eNod4-F Continuous feeding

eNod4
applications

Application for Loss-in-weight feeders



eNod4-F Continuous feeding

eNod4
applications

Application for Loss-in-weight feeders

► Configuration

- Physical or theoretical weight calibration
- Configurable flow rate unit: g/s, g/h, kg/s, kg/h, t/h
- Management of Target flow rate and Target total
- Control output setting (Analog output): Calibration in flow rate, possibility of remote control by external value
- Adjustment of PID controller parameters : Manual or automatic self-adjustment



► Functionalities

- Flow rate calculation by loss-in-weight and continuous weight totalizing
- Pulse output for external Totalizer
- Flow rate regulation by in-built PID controller
- Automatic management of gravimetric dosing phases and refilling volumetric phases.
- Loading cycle management with target on total and inflight correction

► Main alarms and controls

- Empty/Full vessel level, Min/Max Flow rate, Min/Max control output, Max refilling time, min weight variation in refilling, Max time for Batch

eNod4-F Continuous feeding

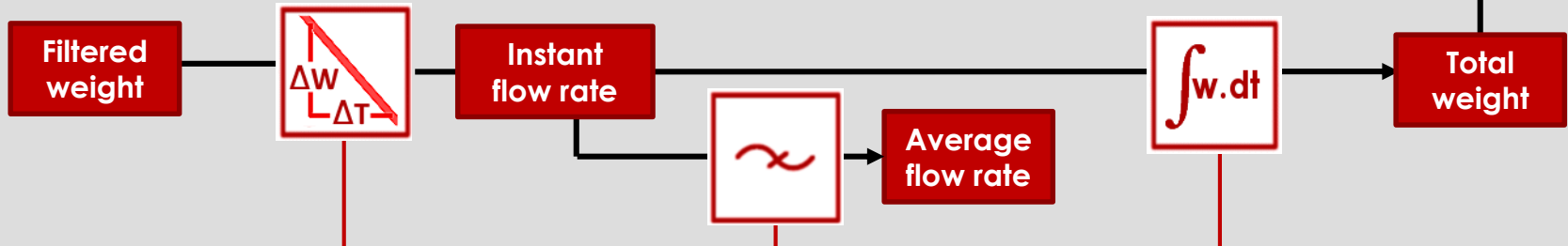
Application for Loss-in-weight feeders

eNod4
applications

Non-volatile memory
storing in each integration period

FRAM

Total & Flow rate calculation

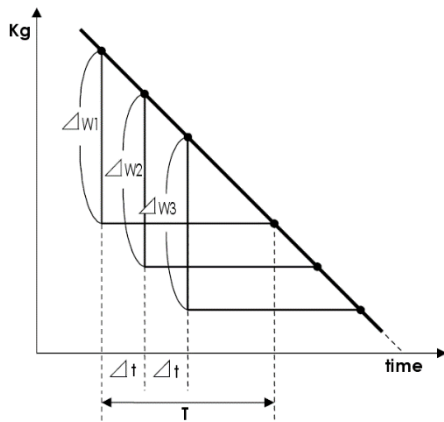


Flow rate filter

Average (2-128)

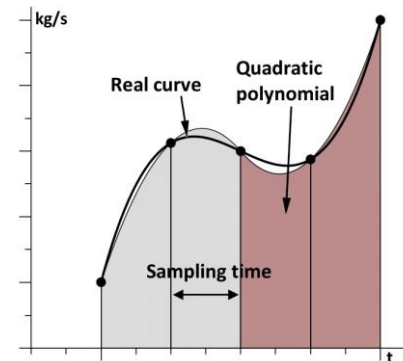
Flow rate calculation

- Δt = Conv. Frequency 6-200 Hz
- T: Flow rate calculation time



Flow rate integration

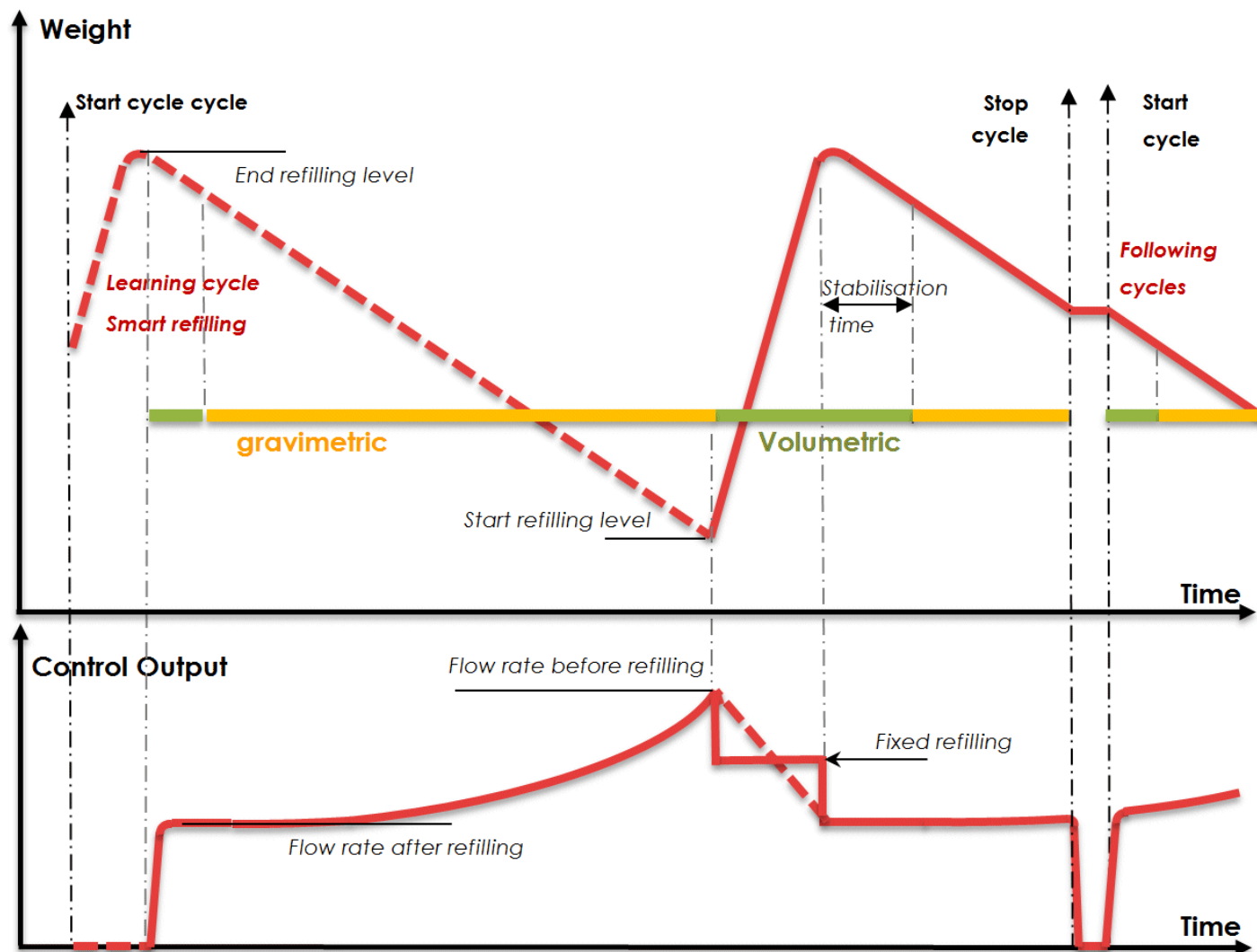
- **Simpson method:** Approximation of the integral using quadratic polynomial
- Integration period: 1 second (6-200 samples)



eNod4-F Continuous feeding

eNod4
applications

Application for Loss-in-weight feeders

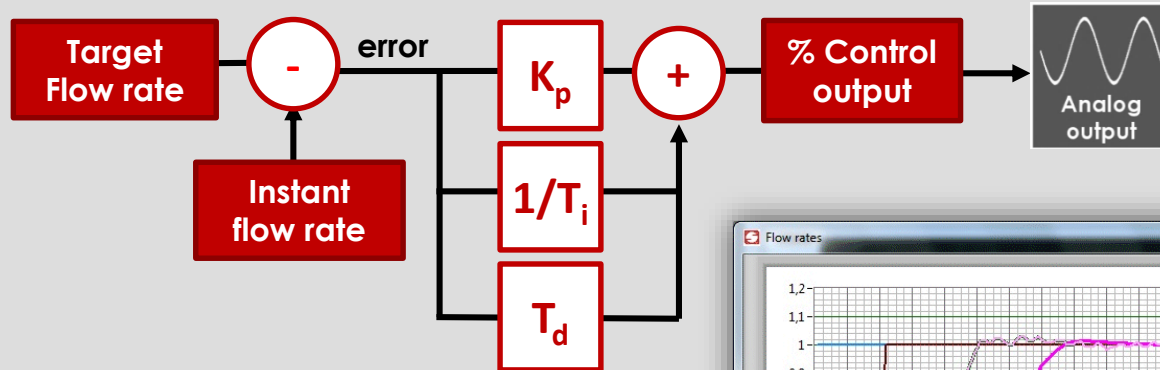


eNod4-F Continuous feeding

eNod4
applications

Setting of PID controller with eNod4 & eNodView

PID controller – Proportional – Integral – Derivative

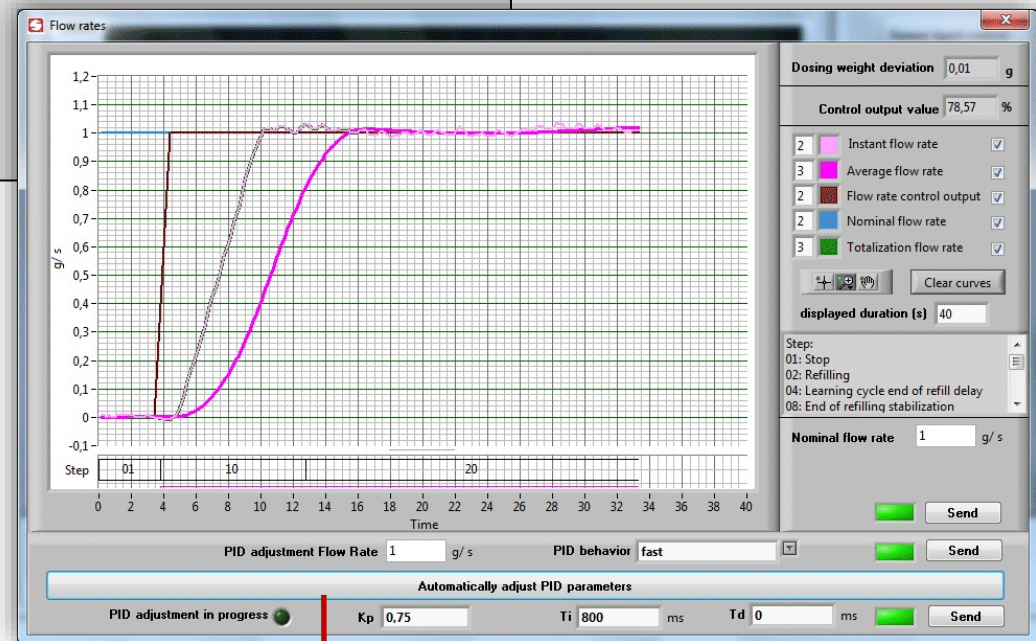


► Manual

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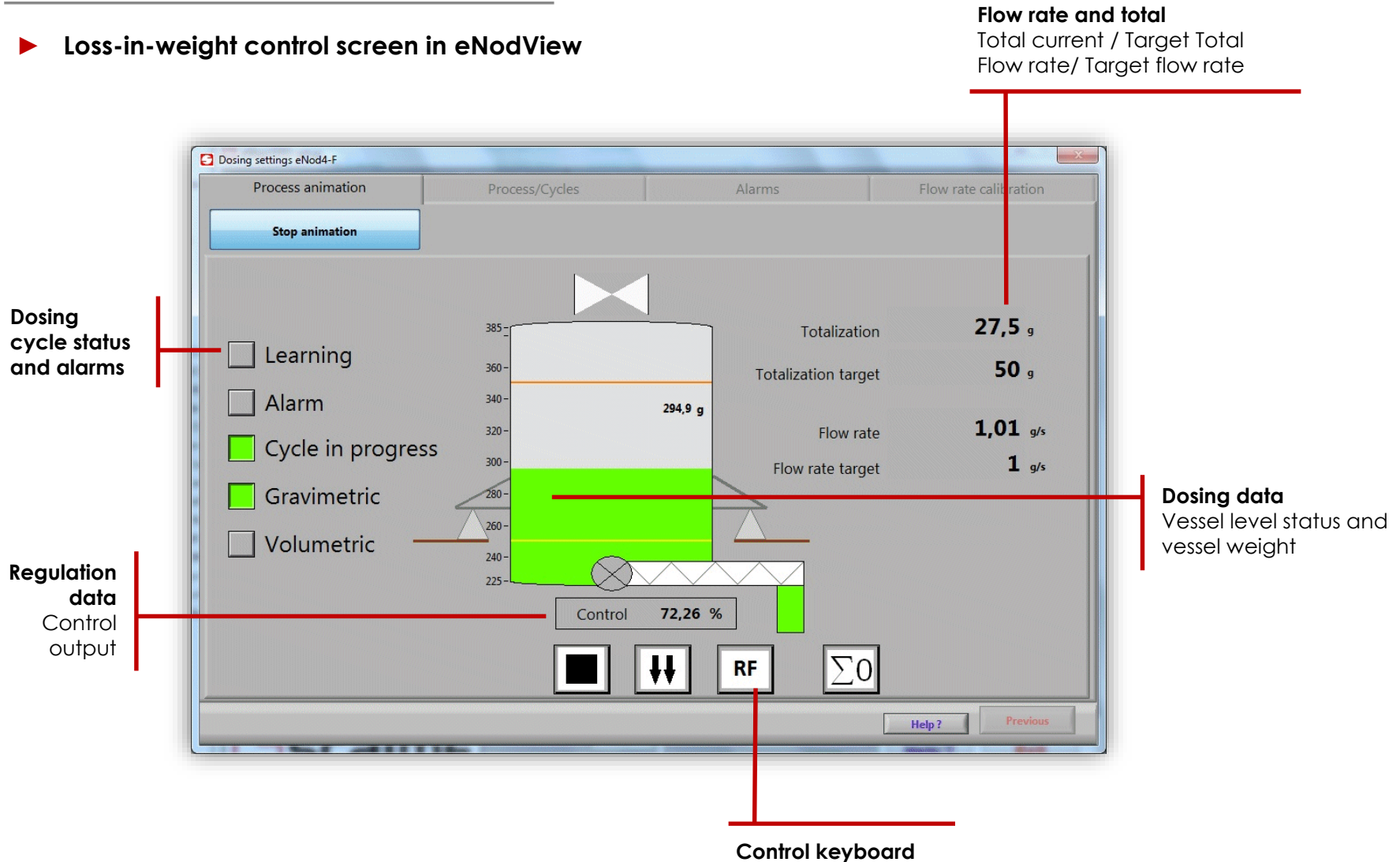
Automatic adjustment of PID parameters

eNod4-F Continuous feeding

eNod4
applications

eNodView functionalities with eNod4-F

► Loss-in-weight control screen in eNodView

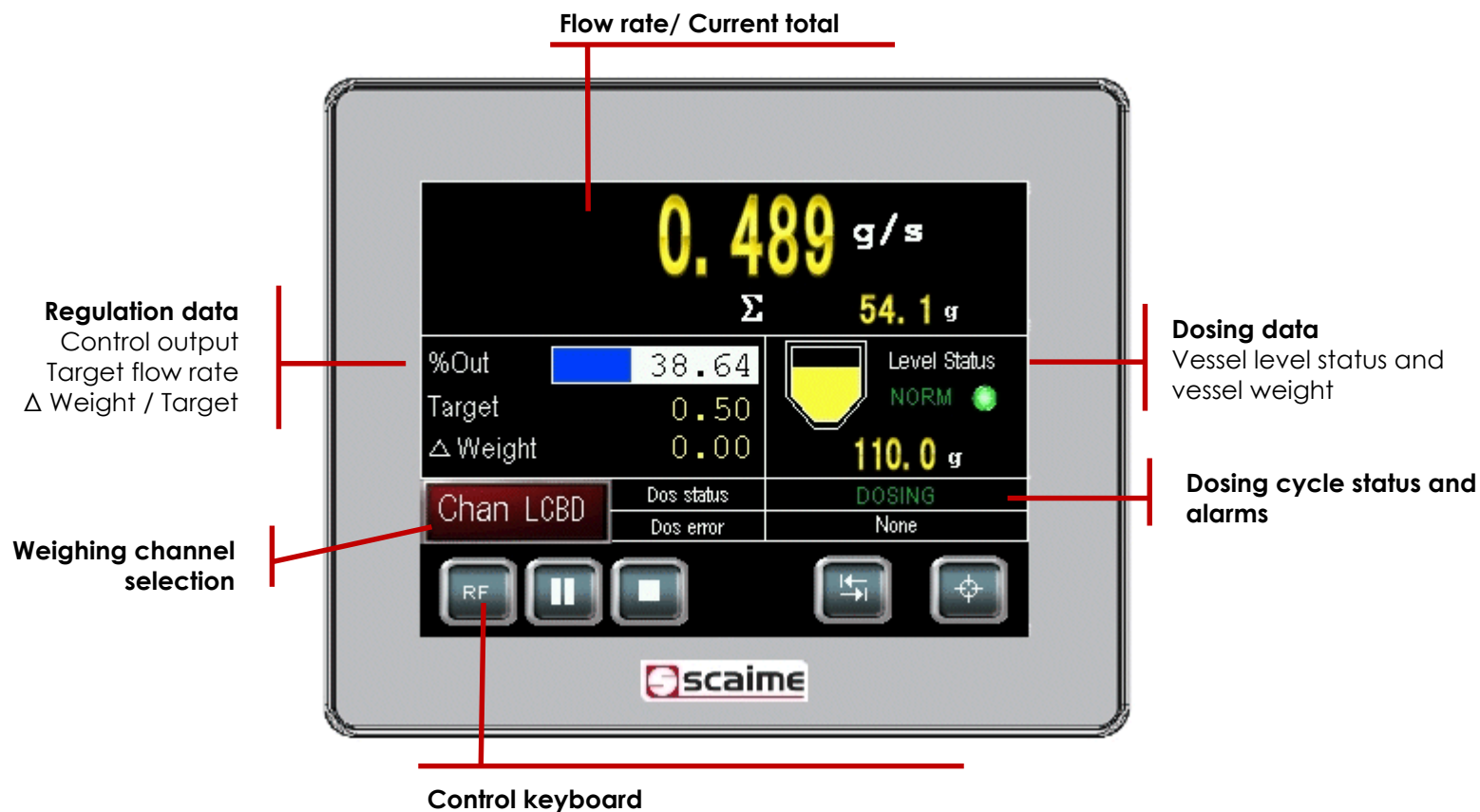


eNod4-F Continuous feeding

eNod4
applications

eNodTouch Functionalities with eNod4-B

► eNodTouch-M or ML main screen



Back



Schneider Electric partnership

Collaborative Automation
by

Schneider
Electric™



Schneider Electric partnership

Back

Presentation

- ▶ Member of Schneider-Electric CAPP (Collaborative Automation Partner Program) since 2008
- ▶ Technological partnership to complete Schneider Electric solutions
- ▶ Interoperability validation with Schneider Electric architectures

Area of expertise

- ▶ Solutions of weighing, dosing and filling

Markets

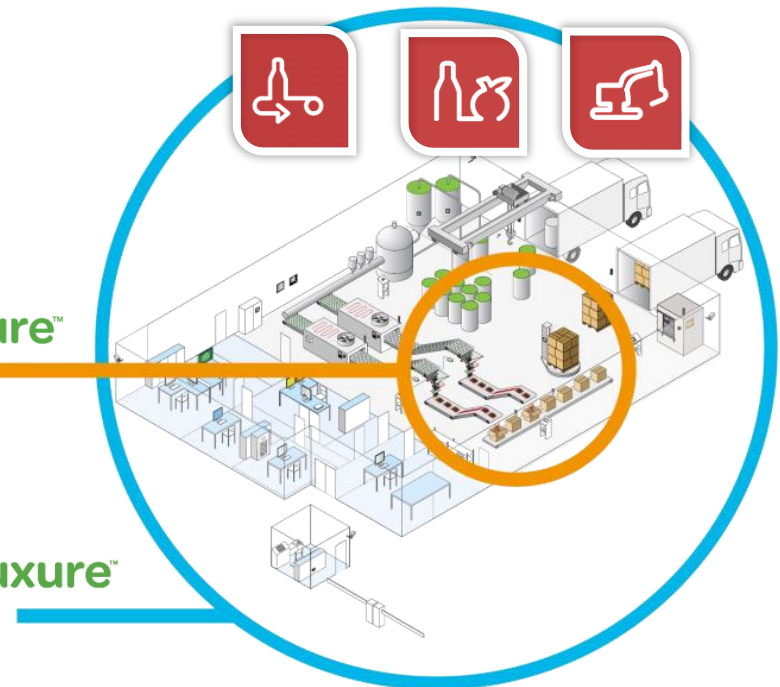
- ▶ Packaging, Food & beverage, mines metals & minerals

Schneider Electric architectures

- ▶ Validated weighing solutions for architectures dedicated to Machine control or Plant engineering.

Machine  truxure™

Plant  truxure™



Schneider Electric partnership

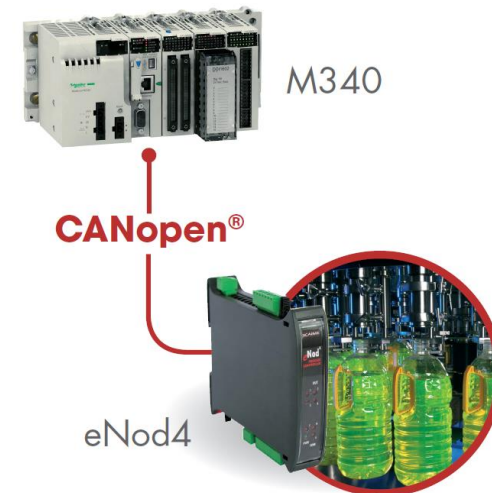
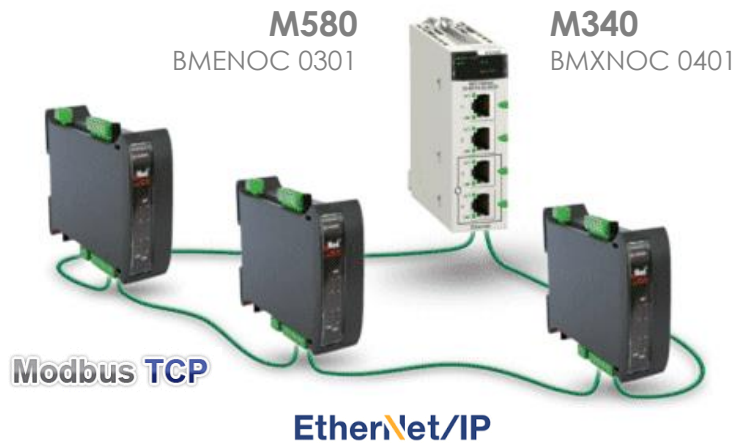
Back

Validated connectivity with Schneider Electric Automation architectures

- ▶ eNod4 CANOpen Communication validated on M340 and M238/M258
- ▶ eNod4 Ethernet/IP & Modbus-TCP Communication validated on BMXNOC 0401 for M340
- ▶ eNod4 Ethernet/IP & Modbus-TCP Communication validated on BMENOC 0301 for M580

Plant  truxure™

Machine  truxure™





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