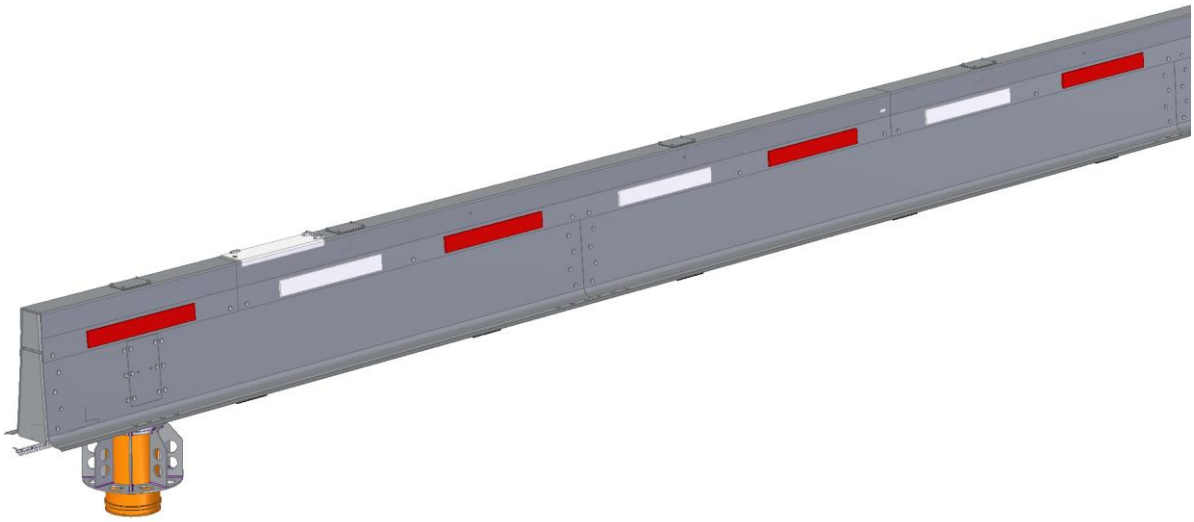
GATEWAY©



Technical Datasheet
GATEWAY™ TA

Revision 22.03.2023

Sagérime SA

Route de la Pâla 11

1630 Bulle

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2 Introduction

The Gateway™ semi-automatic medium barrier gate crossing is a system for opening the center berm on highways for bi-directional vehicle traffic management.

The system has 4 main functions:

1 Locking - unlocking
2 Lifting - lowering
3 Rolling
4 Sequential light system

All functions are electric. The motorization is realized with synchronous servomotors.

The control is adapted to the customer's request. As standard, the operator manipulates the system with a wired controller located at the head of the arm.

The functions from the remote control are processed by an automaton located in a cabinet outside the system (max. 500m)

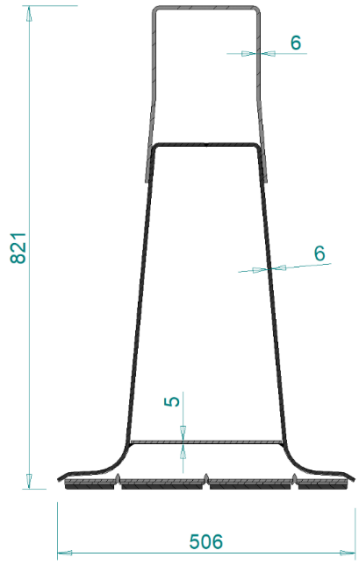
The system requires a three-phase 16A or one phase 20A power supply per arm (without FI or Type B and absorption phases filter)

Network is wired as standard with a Cat 6A network cable.

3 Guard Rail

3.1 Saferoad type Gateway

- Test : H2/W7
- Width 51 cm
- Height 82 cm
- Length of 1 element 6 m



3.2 anti-corrosive Treatment

The system is hot-dip galvanized according to DIN EN 1461

3.3 Dimensions of the system

The length of the gate is 60 m between head and rotation axe.

It is possible to add or subtract 6 meter elements.

4 Lifting system

The lifting system consists of support wheels and drive wheels.

The lifting is carried out by means of mechanical cylinders with trapezoidal screw. The lifting capacity of each cylinder is 25kN. All the lifting screws are mechanically connected by an articulated transmission shaft running along the arm. The lifting of all wheels is synchronous. Adjustable positioning sensors determine the ideal position.

Since the lifting screw is irreversible, an independent brake is not necessary.

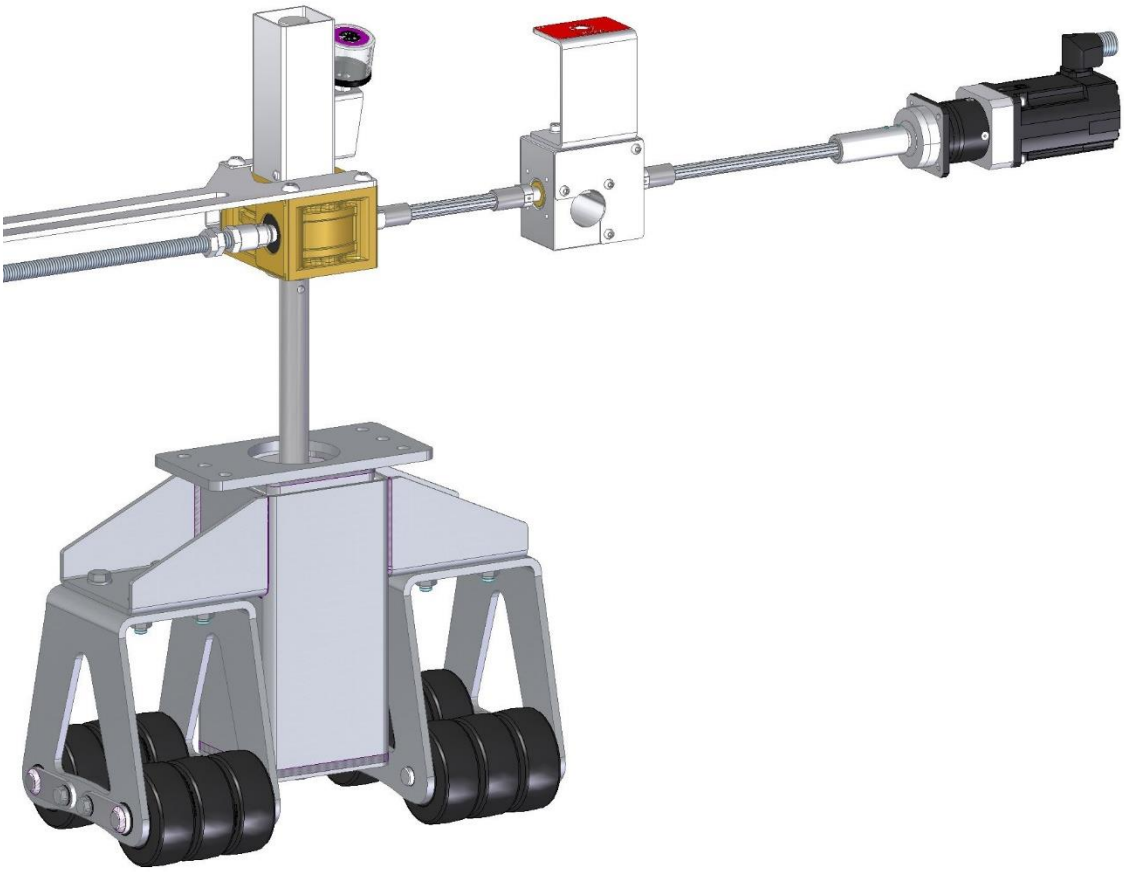


Figure 4-1 Lifting principle

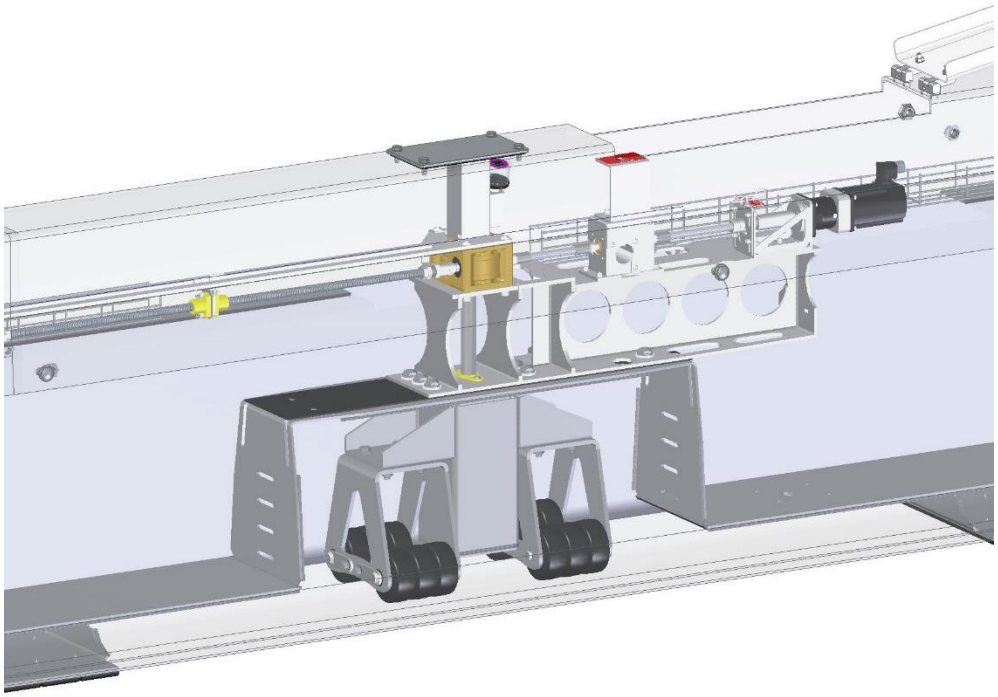


Figure 4-2 GW with support wheel and lifting motor

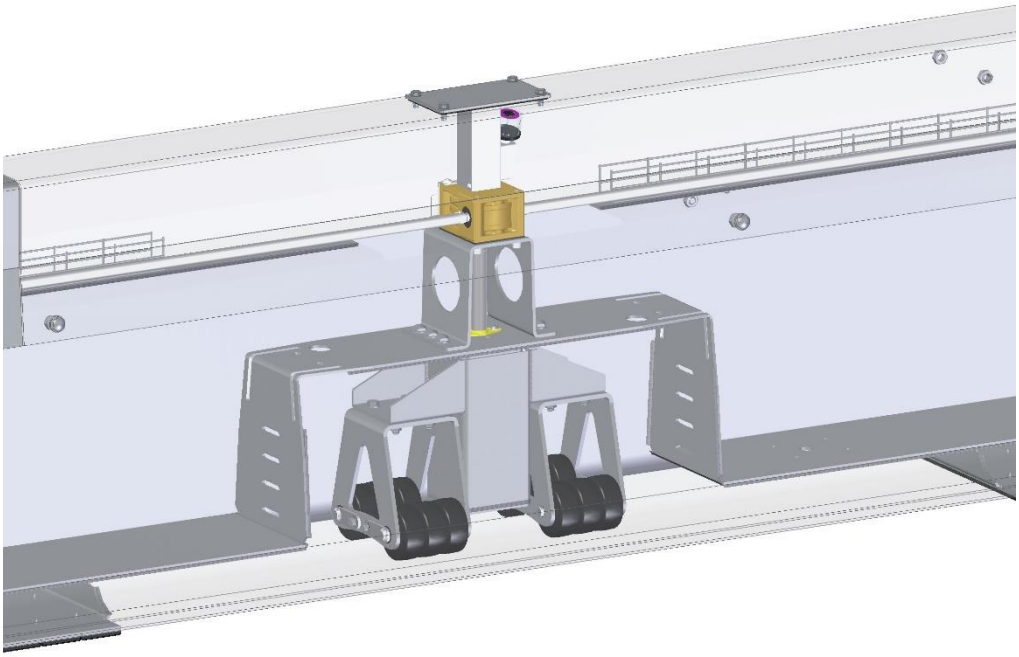


Figure 4-3 GW with Support wheel

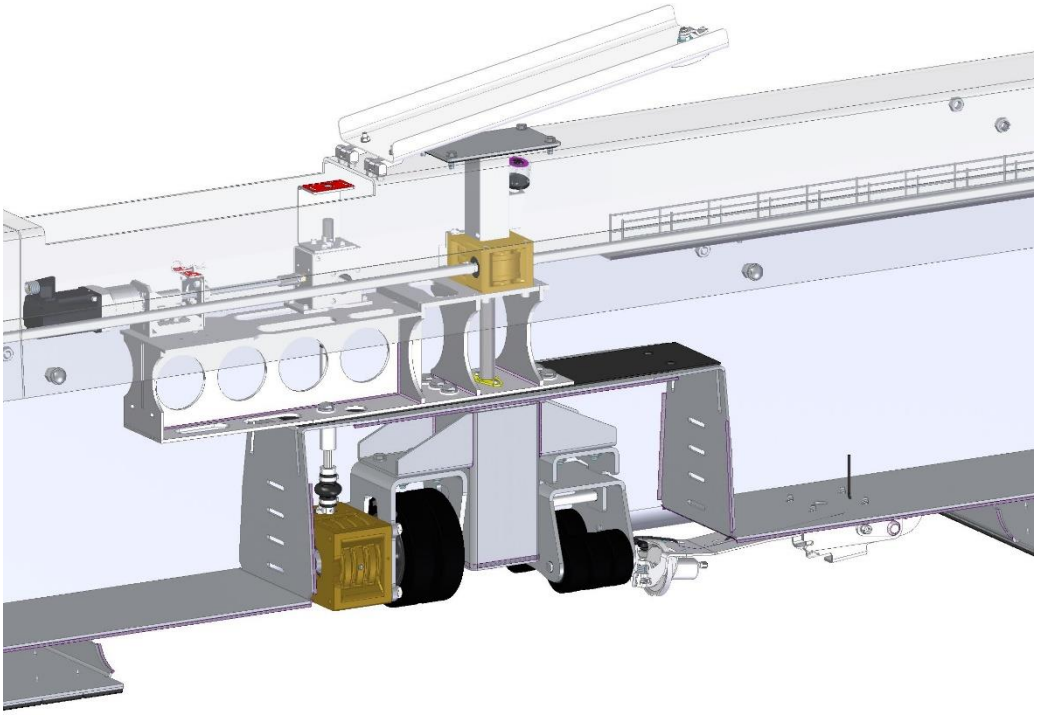


Figure 4-4 GW with drive wheel and drive motor

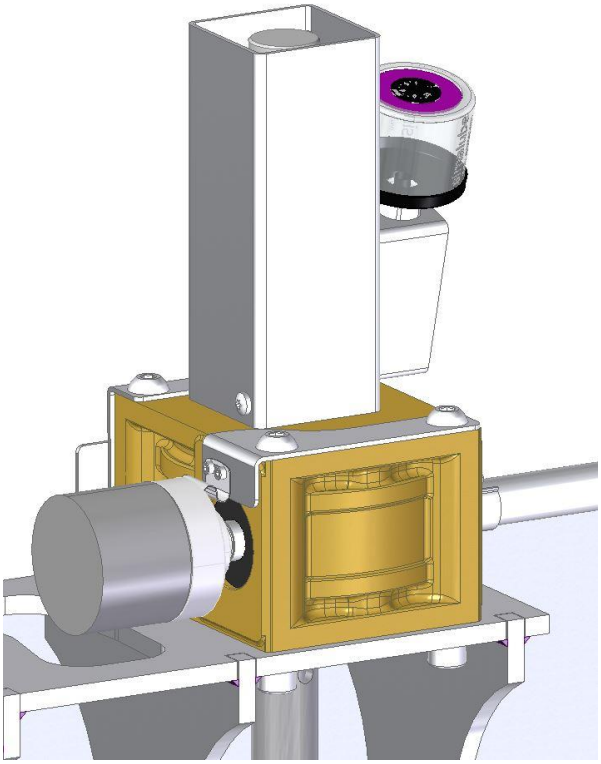


Figure 4-5 Lifting positioning sensors

4.1 Lifting time

The maximum lifting height corresponds to the nominal length of the screws (115mm)

Angular speed of the geared motor: $\omega = \frac{2\pi}{T} = 2\pi f = 32.72\ [rad/s]\ o\grave{u}\ f = 5.21 s^{-1}$

pitch of the lifting screws : $Da[mm/tour] = \frac{1}{2\pi}$

Lifting time for $L = 90mm$:

$$T = L * \frac{1}{Da} * \frac{1}{\omega} = L * 8\pi * \frac{1}{2\pi f} = \frac{4L}{f}$$

The lifting time is **69s** for a normal use.

Depending on the location, the required lifting height may be lower or higher

4.2 Ground Pressure

In order to limit the pressure on the ground as much as possible, the system uses only full elastic rubber wheels of hardness 65° Shore A

Ø roue	100 mm (D)
Largeur bandage	45 mm (T2)
Charge à 4 km/h	270 kg
Alésage Ø	20 mm (d)
Longueur moyeu	45 mm (T1)
Poids unitaire	0,5 kg
Résistance à la température	-25 ° C
Résistance à la température	80 ° C
Dureté du revêtement	65° Shore A
Type de moyeu	Moyeu lisse

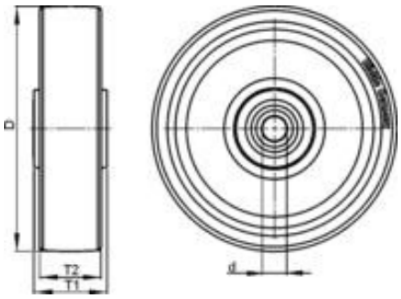


Figure 4-6 Technical data wheel support

Ø roue	200 mm (D)
Largeur bandage	50 mm (T2)
Capacité de charge	350 kg
Alésage Ø	30 H7 mm (d)
Longueur moyeu	60 mm (T1)
Largeur rainure	8 JS9 mm (B)
Hauteur rainure	33,3 mm (H)
Poids unitaire	4,4 kg
Résistance à la température	-30 ° C
Résistance à la température	80 ° C
Dureté du revêtement	65° Shore A
Type de moyeu	Rainure de clavette

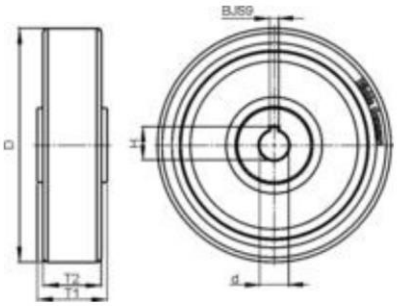


Figure 4-7 Technical data wheel drive

The ground pressure is characterized by the following formula:

$$Pressure\ [MPa] = \frac{Weight[kg] * g}{Surface[mm2]}$$

The weight of the system is approximately 150 kg/m

It therefore exerts a force of 8'830 N every 6m (distance between the points of support on the ground)

1.1.1 Support wheels

The support surface measured per lifting wheel is approximately 21'770 mm2

The pressure exerted on the ground is 0.41 MPa

1.1.2 Drive wheels

The support surface measured per lifting wheel is approximately 18’100 mm2

The pressure exerted on the ground is 0.49 MPa

4.3 Redundancy

In case of system failure, a mechanical 3-way system and a disengagement of the servomotor allows a lifting with a crank or a screwdriver.

4.4 Materials

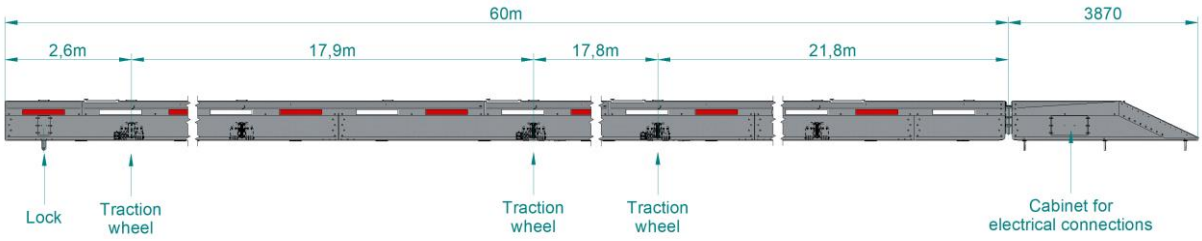
The following materials are used for the lifting system: A4 stainless steel, galvanized steel, bronze, hydrolysis and UV resistant polymers.

Components made of different materials are galvanically isolated by polymer elements.

In general, the materials used are selected for their corrosion resistance and electronegative compatibility.

5 Drive elements :

To ensure the alignment of the arms and an optimal motricity, each arm is equipped with 3 drive wheels. 1 at the end of the arm at the level of the opening and 2 in central position



The combination of power and reduction of the system as standard allows to overcome slopes of ±10° or 17%. It is of course possible to increase these values significantly at the cost of a reduced speed.

5.1 Alignment in closed position

The alignment of the arm in closed position is ensured by proximity sensors mounted under the arm and elements sealed in the asphalt.

5.2 Drive system

The driving principle is more or less identical to the lifting system. It uses the same type of servomotor and gearbox.

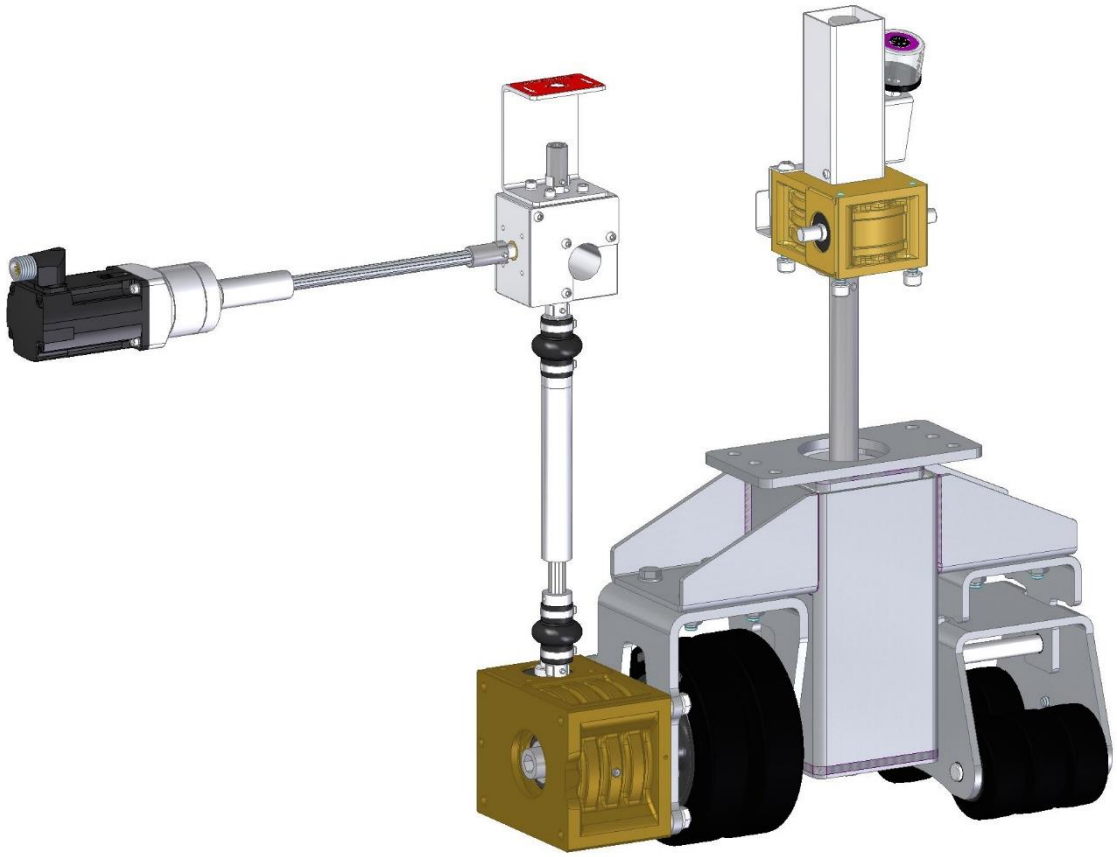


Figure 5-1 Principle of driving

5.3 Driving speed

Angular speed of the geared motor: $\omega = \frac{2\pi}{T} = 2\pi f = 74.61\ [rad/s]$ où $f = 11.875 s^{-1}$

Reduction gear :$Re = \frac{1}{47}$

Speed of the head drive wheel of the system: $v = f * Re * D * \pi = 0.158\, m/s$

5.4 Driving time

Considering a standard highway and a system with 60m arms, the opening time for 7m lane is about 44s.

5.5 Redundancy

In case of system failure, a 3-way mechanical system and a disengagement of the servomotors allows the arm to be operated with 3 cranks or 3 screwdrivers.

5.6 Materials

The following materials are used for the lifting system: A4 stainless steel, galvanized steel, bronze, hydrolysis and UV resistant polymers.

Components made of different materials are galvanically isolated by polymer elements.

In general, the materials used are selected for their corrosion resistance and electronegative compatibility.

6 Locking system :

- Vertical locking pin
- The pin is locked in closed position by a motorized vertical lock.
- Lowering in open or close position
- Expansion is taken up by the locking box for maximum ease of use.

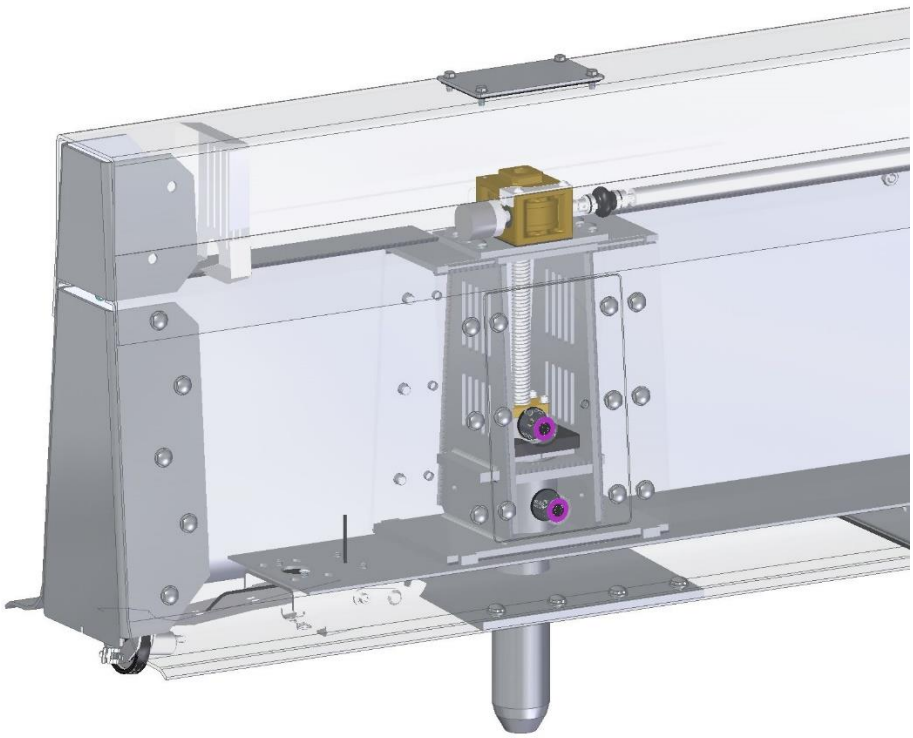


Figure 6-1 TA lock

6.1 Dilatation

Dilation: Δt x LBw x 0.012 = Δs mm = 100K x 50 m x 0.012 mm/m K = 60 mm

The expansion element integrated in the opening can move ±50 mm (total 100 mm)

6.2 Unlocking time

Opening/closing time of the vertical lock: 25 seconds and can be performed simultaneous with the lifting procedure.

6.3 Redundancy

In case of system failure, a 3-way mechanical system and a disengagement of the servomotors allows the arm to be operated with 3 cranks or 3 screwdrivers.

6.4 Materials

The following materials are used for the lifting system: A4 stainless steel, galvanized steel, bronze, hydrolysis and UV resistant polymers.

Components made of different materials are galvanically isolated by polymer elements.

In general, the materials used are selected for their corrosion resistance and electronegative compatibility.

7 Automation :

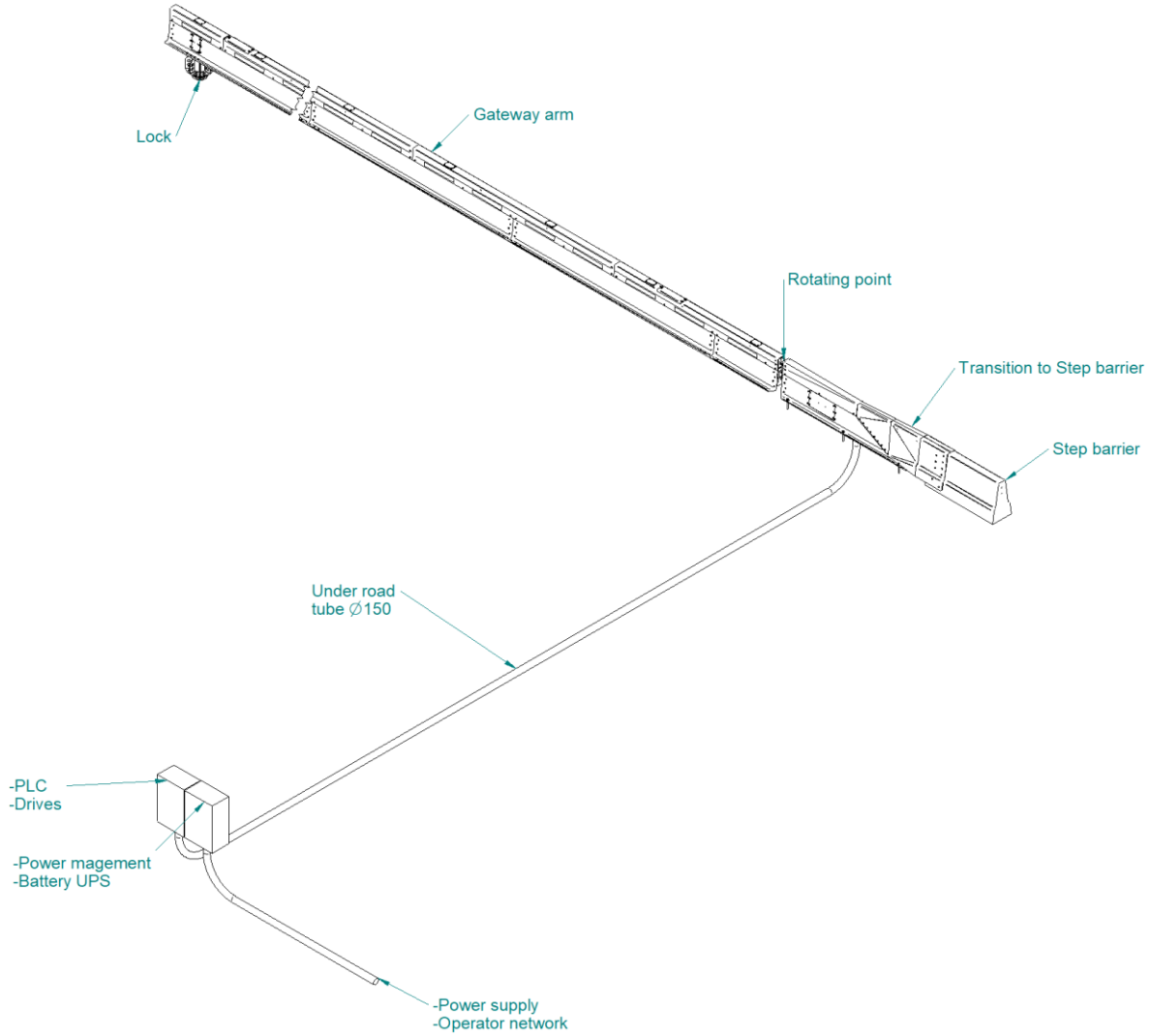
- Control of the electromechanical elements (including sequential lighting) from 1 control panel for the entire detour passage
- Electric lifting
- Lifting time: approx. 1-2 minutes depending on the required high
- Electrical unlocking :
- Unlocking time: approx. 1 minute
- Electric rolling
- Opening/closing time: approx. 1 minute for a complete opening
- All motors can be unlocked for manual operation with a hand crank or electric screwdriver in case of failure.
- Can be operated on generator in case of power failure.
- Automatic mechanical (not electrical) brake in the raised position to prevent unwanted movement of the system.

8 Control system :

8.1 Installation layout :

The control system of the detour passage is contained in different cabinet.

- 1 Cabinet with control system and motor drives
- 1 Cabinet for power supply with battery redundancy



The field unit requires a one or three-phase 16 A power supply (depending on customer choice), as well as the link for the transmission of the status of the passage to the road management system

8.1.1 Field cabinet

The field cabinet includes the following components:

- PLC
- 24V Power supply for the PLC

- Heating to prevent freezing and condensation.
- AC unit to prevent overheating and condensation.
- Thermostat, hygrostat
- 48V power supply for the sequential beaconing(optional)
- Power drives for motors

8.1.2 Field remote control

The remote control allows you to control the following functions:

- Emergency stop
- Locking / unlocking
- Lifting / lowering
- Rolling forward / backward
- Automatic return to closed position
- Automatic positioning: optional

Figure 8-1 Wired remote control

8.1.3 Sensors

- Lift positioning: absolute sensor (also working without power during manual operation)
- Displacement positioning: magnetic sensors are located at the traction wheels. Magnetic references are cast into the asphalt.
- Displacement positioning: absolute coder wheel
- Positioning of the vertical lock: high and low sensors.

8.1.4 Cables

All wiring is PUR-PUR for maximum durability. The connectors are of minimum category IP 67 with gold-plated contacts.

The system is organized in modules of 6m including the cables, which allows for a significantly shorter intervention time in case of damage.

Cables trough cabinet and passage are special armored cable with PVC jacket.

8.1.5 Safety

- All operations performed with the remote control require the operator to continuously press the button.
- Emergency STOP on the remote control.
- All the components are protected against incorrect use thanks to the different sensors.
- STO certified PLC

8.1.6 Maintenance

The system performs a daily maintenance cycle on its own.

In general, the system is designed for minimal maintenance.

Annual maintenance consists of a yearly visual inspection of the various mechanical components and the replacement of 13 automatic grease mini cartridges. These certified cartridges are available worldwide.

All mechanical components have been tested without lubrication for use in 7500 continuous cycles (unlocking, lifting, moving, lowering, lifting, moving, lowering, locking). Beyond this duration, replacement of some mechanical components may be required.

9 Automated operation

The normal operation of the gate is a succession of "transitions" between different so-called stable states.

9.1 States

There are stable or nominal states. and unstable states that cause the system to go into alarm.

For example, it is impossible for the system to be both open AND moving in normal circumstances.

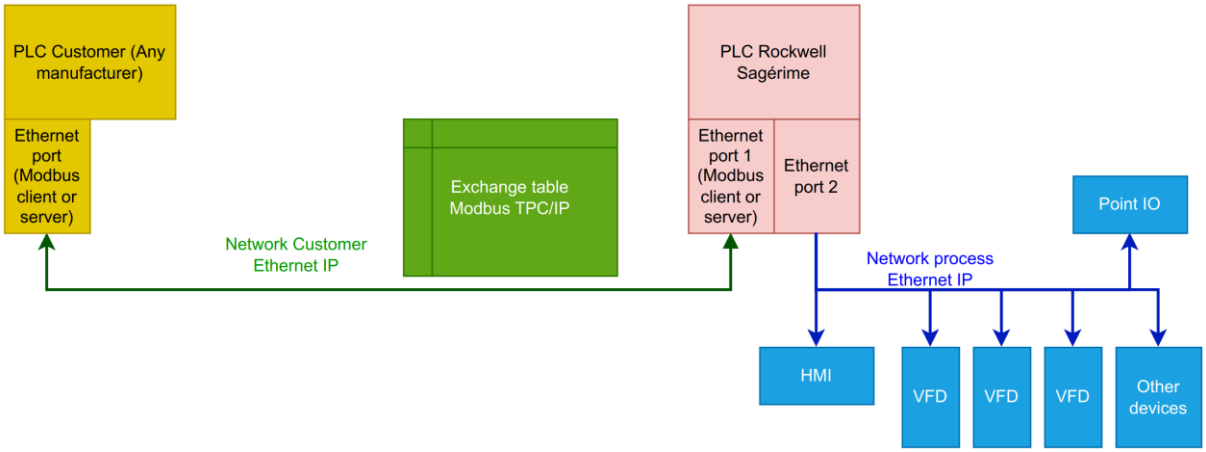
Understanding these different states is fundamental. Indeed, when the system reaches a sensor determining a movement, it changes state and is ready for the next maneuver. This

state management is essential for control stability because the system is subject to extreme variations in expansion that regularly cause it to "lose" certain sensors.

In order to make the system resilient, especially in case of manual emergency use; absolute sensors allow for a direct return to a stable state when energy is restored without requiring a reset protocol. Tolerance ranges allow the system to operate under normal highway conditions with significant temperature variations.

9.2 Remote interface

The system is designed to be operated remotely from a control center. We use automation market standards with Modbus exchange table to ensure maximum system interoperability and security.



9.3 Local control interface

The passage is normally controlled remotely by the operating center. It is possible to control it locally for maintenance or malfunction purpose, either with the remote control located at the head of the arm or by the touch HMI in the cabinet.

The local interface consists of a water, dust and heat resistant field HMI.

9.3.1 Emergency stop

The interface is accompanied by a separate physical emergency stop. The entire system is STO certified, i.e. activation of the emergency stop, loss of communication or any other alarm will instantly cut power to the motors.

10 Procedure for manual operation

The gate can be used manually in the event of a power outage or other problem. However, this procedure should only be run by people trained by Sagérime SA. This procedure presents a risk of damage to the mechanical elements of the diversion passage and must therefore be carried out very carefully.

Sagérime SA can in no way assume warranty cases in case of inappropriate use of this procedure.

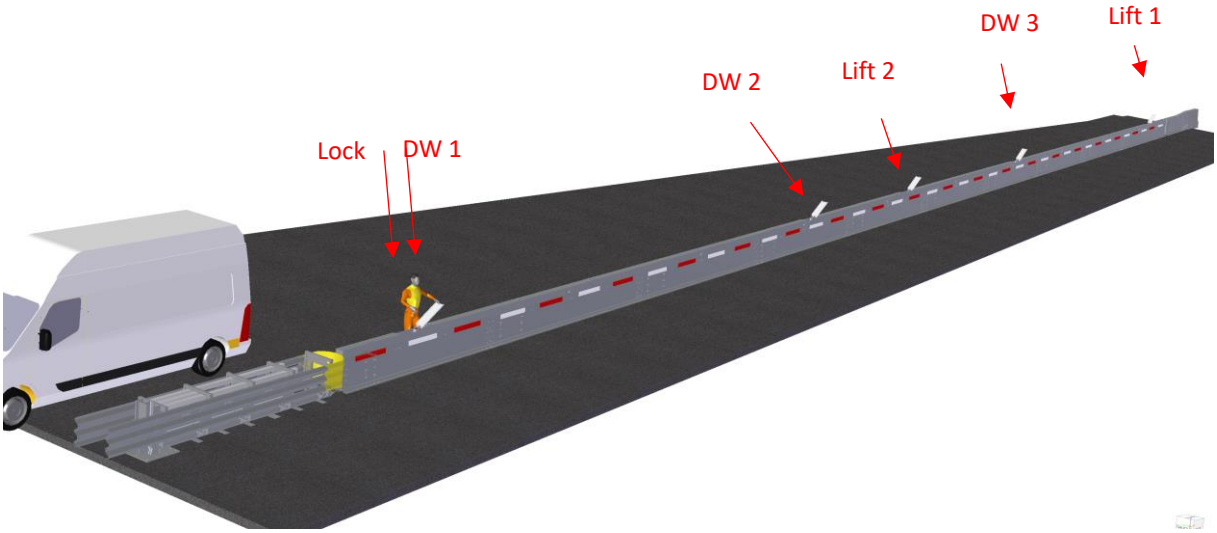


Figure 10-1 Manual operations

10.1 Step 1: Disengagement

Disengage the following different motors on each arm under the hoods located on the upper part of the system:

- Lifting 1
- Lifting 2
- Drive wheel 1
- Drive wheel 2
- Drive wheel 3
- Vertical locking

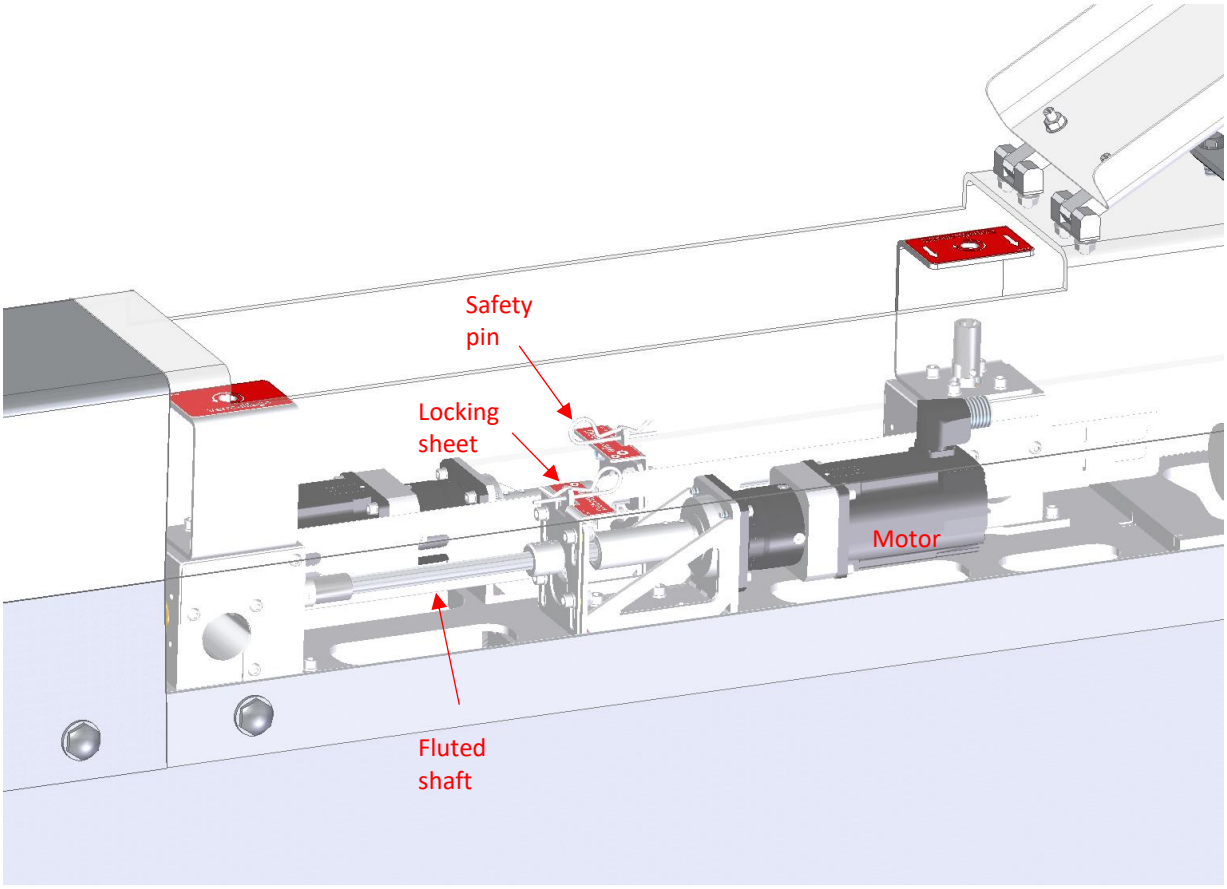


Figure 10-2 Engine clutch

To disengage an engine, the steps are as follows:

1. Remove the safety pin.
2. Pull up the locking sheet marked "Disengagement».
3. Move the fluted shaft in the direction of the motor to the stop.
4. Lower the locking sheet marked "Disengagement».
5. Replace the safety pin.

10.2 Step 2: Tools

Take the cranks and fluted shaft in the first box since the opening of the passage. The system can also be used using fluted shafts, a 12/13 mm socket and a battery screwdriver.

For all stages, be careful not to overload the system. It is recommended to use the torque limiter of the battery screwdriver set to a torque of:

1. 30 Nm for lifting.
2. 5 Nm for the lock.

The reduction of the mechanisms is very high, therefore the number of turns to be performed is important. The use of an electric screwdriver saves time.

10.3 Step 3: changing gate position

To move the system, use the following procedure:

1. Open the vertical locking pin
2. Raise the arm of the system to be moved by about 5 cm;
3. Move the arm using all 3 drives synchronously. So, 3 people are needed for this step.
4. Engage the vertical locking pin.
5. Lower the system to the center.

The return to normal service must be done by a certified technician.

All these steps can be performed by 3 2 or even 1 person. The global procedure is the same, but the steps are a bit different and longer.

1. Same
2. Lifting the system
    1. Raise lifting 2 at approx. 50%
    2. Raise lifting 1 at 100%
    3. Raise lifting 2 at 100%
3. Move the arm using all the drive alternately. Each drive should only be moved a small distance.
4. Engage the vertical locking pin.
5. Lower the system.
    1. Lower lifting 2 at approx. 50%
    2. Lower lifting 1 at 0%

3. Lower lifting 2 at 0%

10.4 Time needed for manual moving procedure (without unlocking-locking):

3 people	4.5 min.
2 people	5 min.
1 person	10.5 min.

The locking or unlocking take approximatively 30 sec.