

Monitoring data storage

Preventive maintenance and monitoring data logging of operating parameters.

The monitoring data storage function is based on a controller device for acquiring, recording and providing warnings on relevant and critical issues for preventive maintenance purposes. It provides information on the working safety period of the gear box, improper crane operations and important occurrences such as overload and overspeed.

Benefits

Optimisation of safety equipment service life

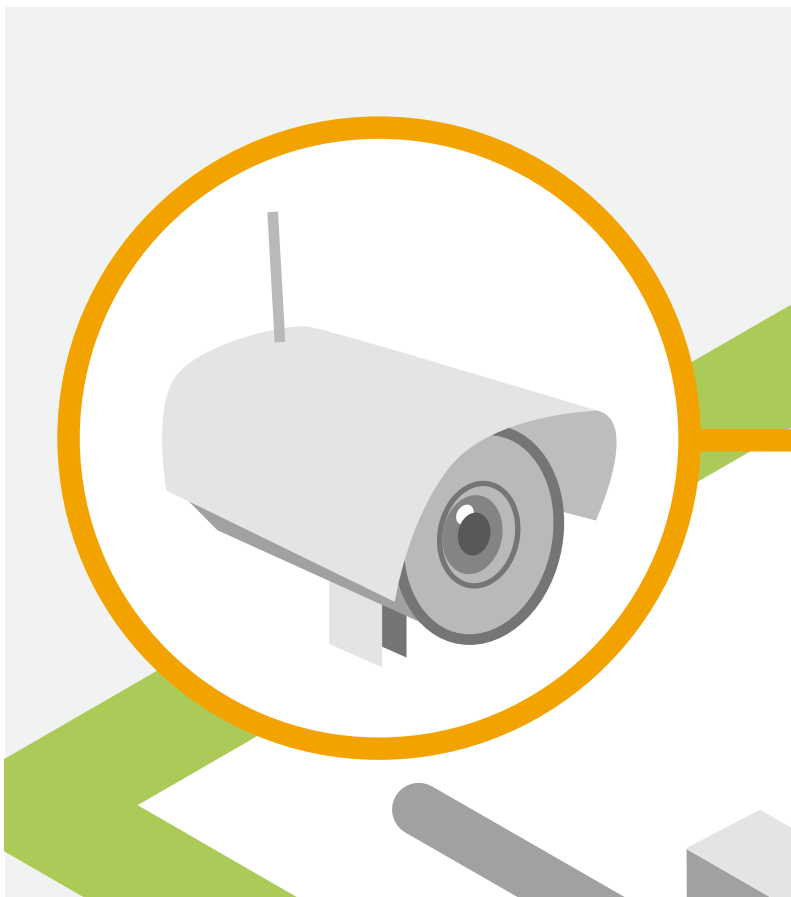
- Maximum use of critical equipmentsuch as the gearbox via automatic calculation of the working safety period.

Prevent problems from becoming maintenance issues

- Reliable and up-to-date crane diagnostics through historical data maintenance.

Save maintenance time

- By determining the origin of the problem before solving it.



Operating principle

Maintenance data storage:

For acquiring, warning and recording the most relevant maintenance data. The goal is to provide efficient maintenance information coordinated with the crane's operations. This function calculates the working safety period by counting the working hours and taking into account the load weight which was hoisted during these working hours.

Event warning and recording:

Notification and recording of critical events such as overload, overspeed, load slipping, and encoder faults to enable the complete diagnostic of the crane.

Improper crane operations data register:

This detects operations such as pulsating or backtracking that can impact the service life of the equipment and increase maintenance service time.

Characteristics

•All movements are controlled:

While the main movement controlled is hoisting, these function blocks can control all movements simultaneously.

• Maintenance data storing:

- Working hours and number of operations by movement
- Working hours at 300 and 600 operations per hour
- Working Safety Period (WSP) by using load cell or drive estimation

• Event warning and recording:

- Overload and overspeed recording: last 20 events, including, date and duration
- Load slipping (accumulated events)
- Encoder fault (accumulate events)
- Configurable alarm for all these event

• Improper crane operations data register:

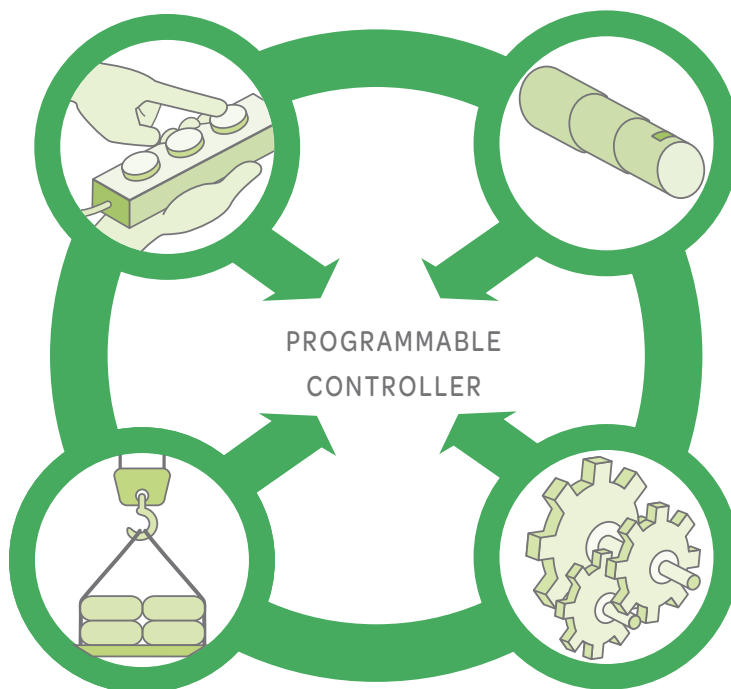
Pulsating and backtracking register for all movements selected

Typical applications

- Self-erecting cranes
- Tower cranes

Typical architectures

- Simple hoisting
Compact / Hardwired / Logic controller / Zelio Logic
- Optimized hoisting
Compact / CANopen / Drive controller / ATV-IMC



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Load overspeed control

Increase protection of crane equipment and reduce risks.

Internal faults can generate load slipping which can lead to an increase in load speed to and associated risk. Load overspeed control is based on a sensor and a controller. When the nominal speed is exceeded, the controller must trigger an emergency stop and the function sends an alarm to control the situation.

Benefits

Reduce risks

- Prevent the load from falling.

Increase equipment protection

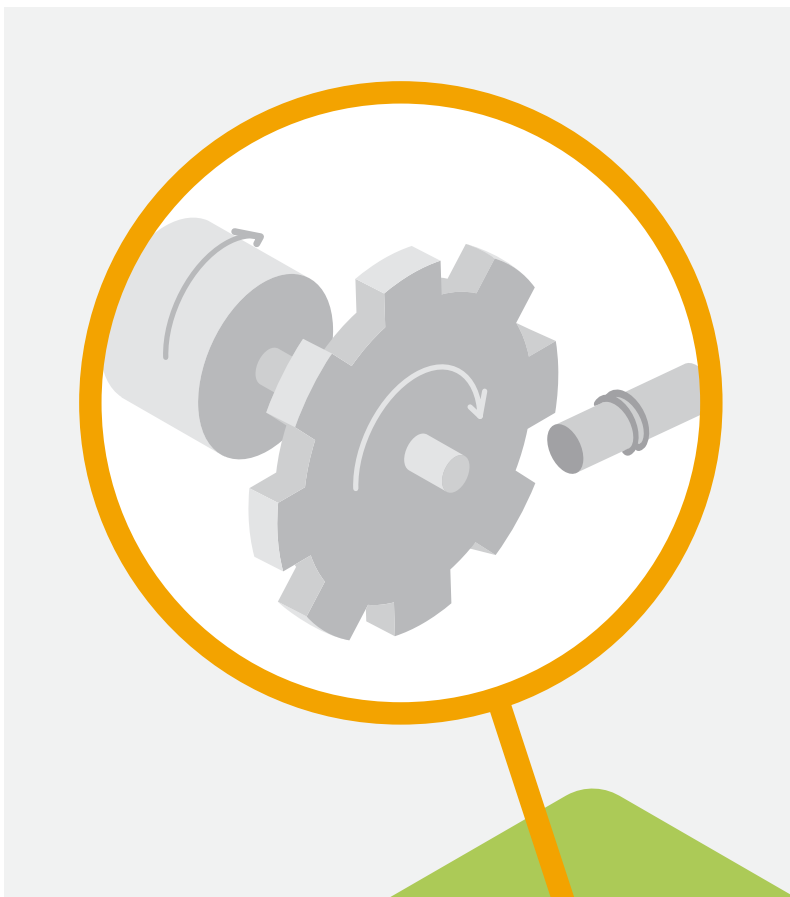
- Prevent damage to the gear box and motor.

Optimised and compact installation

- A dedicated device is not required; the same controller can be used for several functions.

Complete diagnostic

- The most recent overspeed events, with time and date, are recorded as part of the preventive maintenance and monitor.



Operating principle

The objective is to control the nominal speed of the load. The controller must initiate an emergency stop when the speed value is over 110% of threshold speed selected in each movement direction.

Characteristics

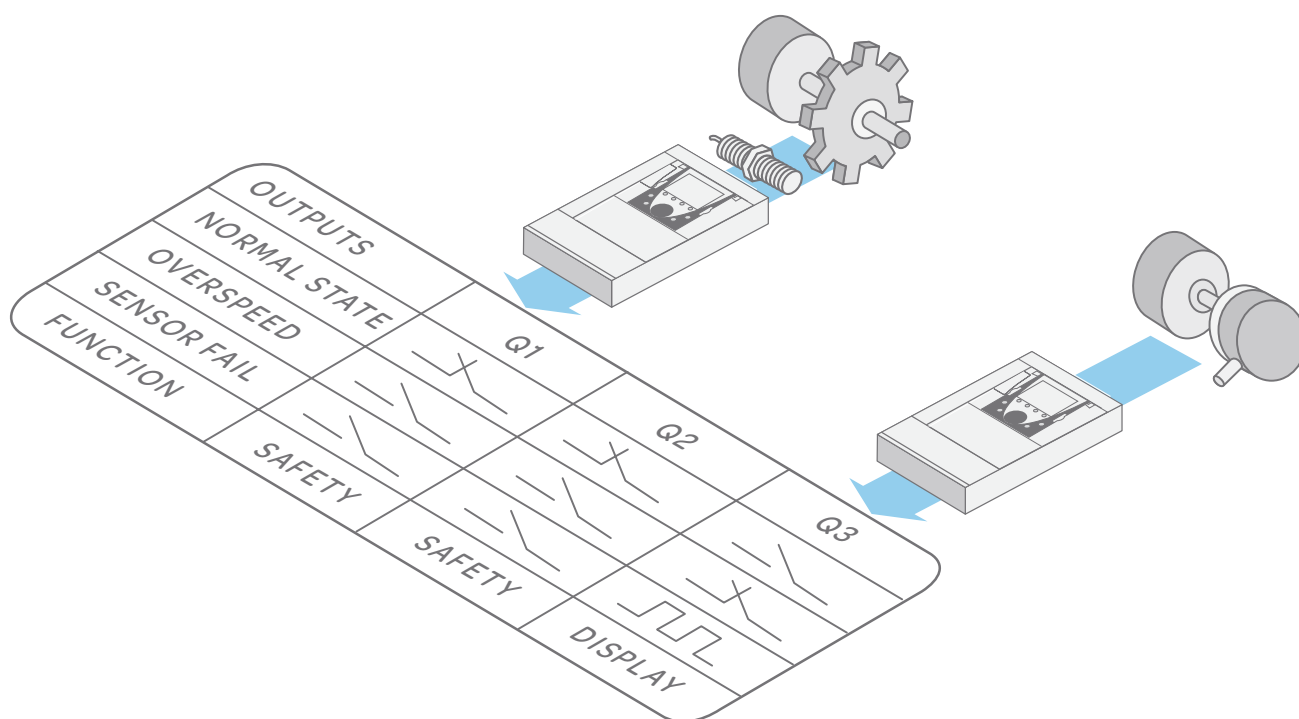
- The motor speed signal comes from a proximity sensor. It detects the metal cam wheel linked to the drum of the hoisting rotation axis.
- An encoder can be used instead of a proximity sensor; it should be installed in the drum of the hoisting rotation axis
- Time and date of the most recent events are recorded for maintenance diagnostic

Typical application

- Tower cranes

Typical architectures

- Simple hoisting
Compact / Hardwired / Logic controller / Zelio Logic
- Optimized hoisting
Compact / CANopen / Drive controller / ATV-IMC



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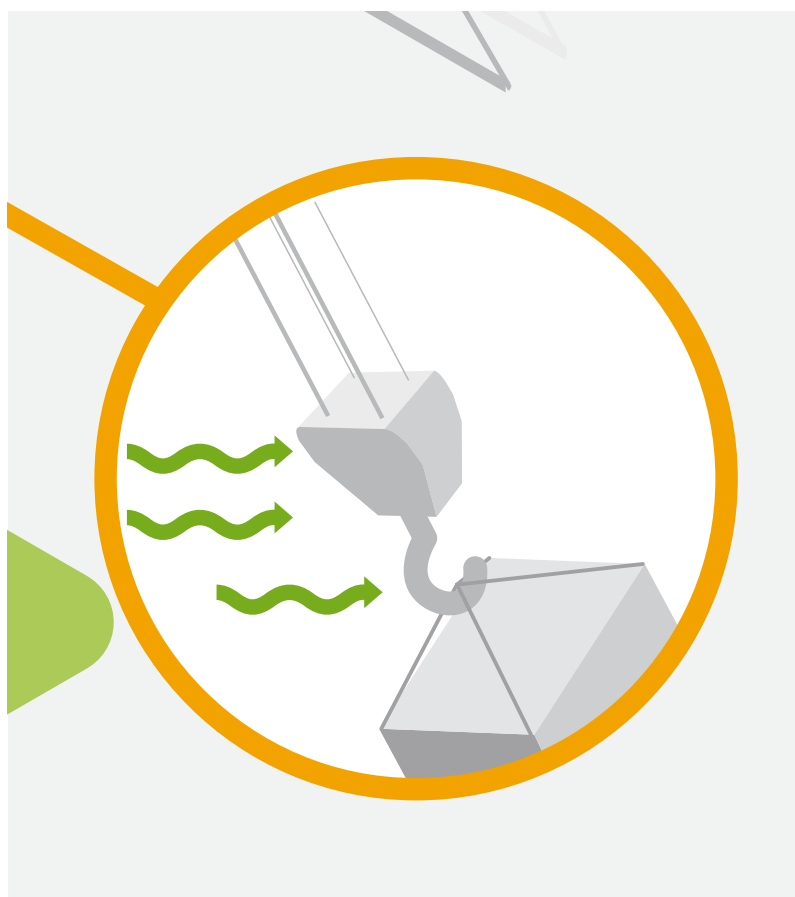
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Wind speed control

Detect high wind events.

The wind speed control function constitutes a preventive measure against risk associated with strong winds. It is based on an anemometer and a controller that detects and sends an output signal to inform operators that maximum wind speed has been exceeded to continue operations.



Benefits

Reduce risks

- Prevents the crane from toppling over.

Reliable control system

- Detection of lock or failure of the anemometer.
- Crane control is restricted to prevent the risk of unauthorised operation.

Flexible and customised

- Adjustable filter time to prevent gusts of very short duration from triggering false alarms.
- Warning and alarm setpoints configurable according to local regulations.
- Anemometer with analogue output or pulsed output is allowed.

Optimised and compact installation

- A dedicated monitoring device is not required; the same controller can be used for several functions

Complete diagnostic

- The most recent excessive wind speed events, with time and date, are recorded as part of the preventive maintenance and monitoring.

Operating principle

The anemometer detects the speed of the wind by generating an analogue or pulsed output and the controller sends a pre-alarm by activating a flashing light (orange) and intermittent audible signals when wind speed is higher than 50 km/h.

At the same time the function sends a maximum wind overspeed warning (72 km/h in standard cranes, configurable according to local regulations) with a steady light (red) and continuous audible signal indicating to the operator that crane could be parked on a free slewing jib. The system registers and resets this alarm when the crane is out of service or after a preset time configurable by user.

Characteristics

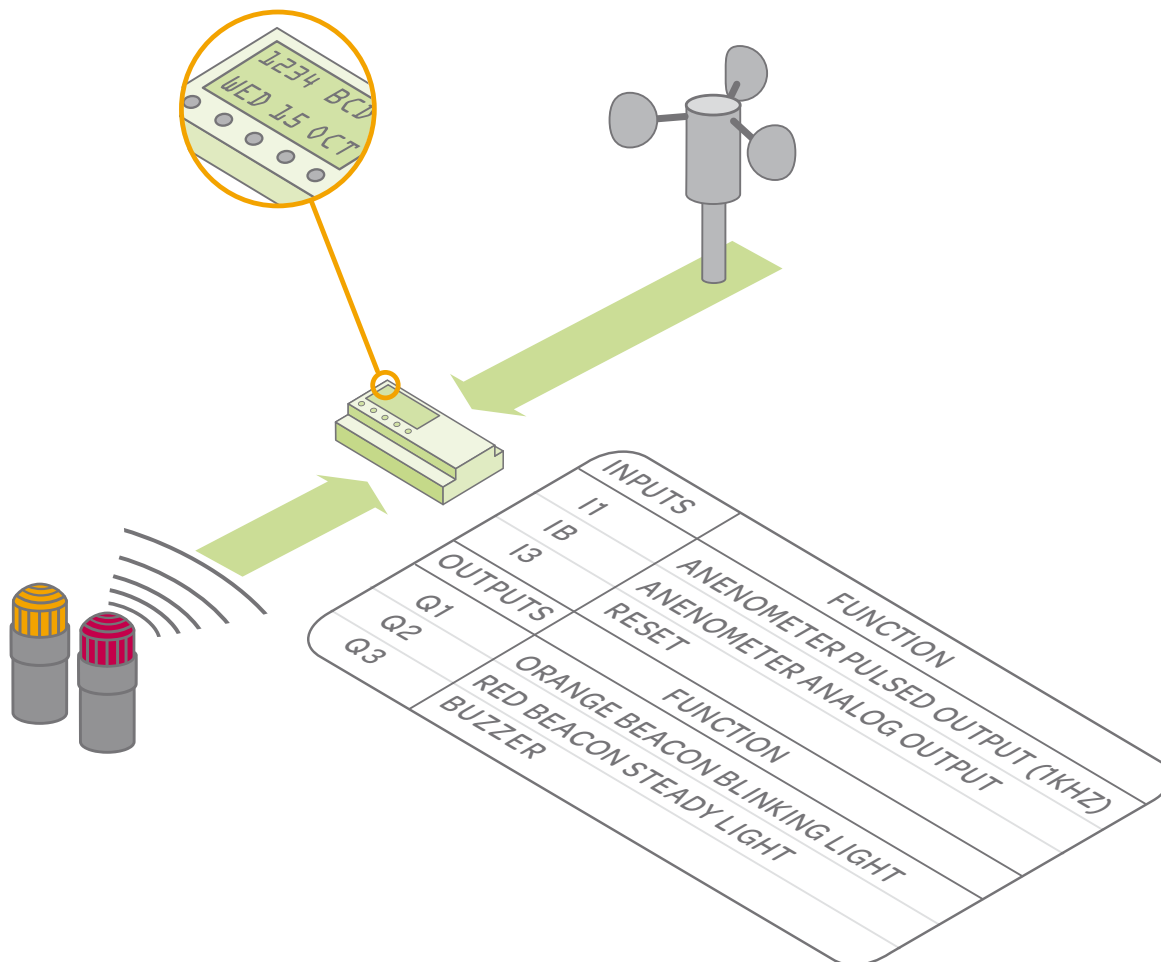
The wind speed control function is based on an anemometer and a controller. Two beacons, an orange and a red light with an audible signal, are needed. At the same time the operator can view the wind speed information on a screen, including the dates and times of the most recent speed events, on the display integrated in the controller.

Typical applications

- Self-erecting cranes
- Tower cranes

Typical architectures

- Simple hoisting
Compact / Hardwired / Logic controller / Zelio Logic
- Optimised hoisting
Compact / CANopen / Drive controller / ATV-IMC



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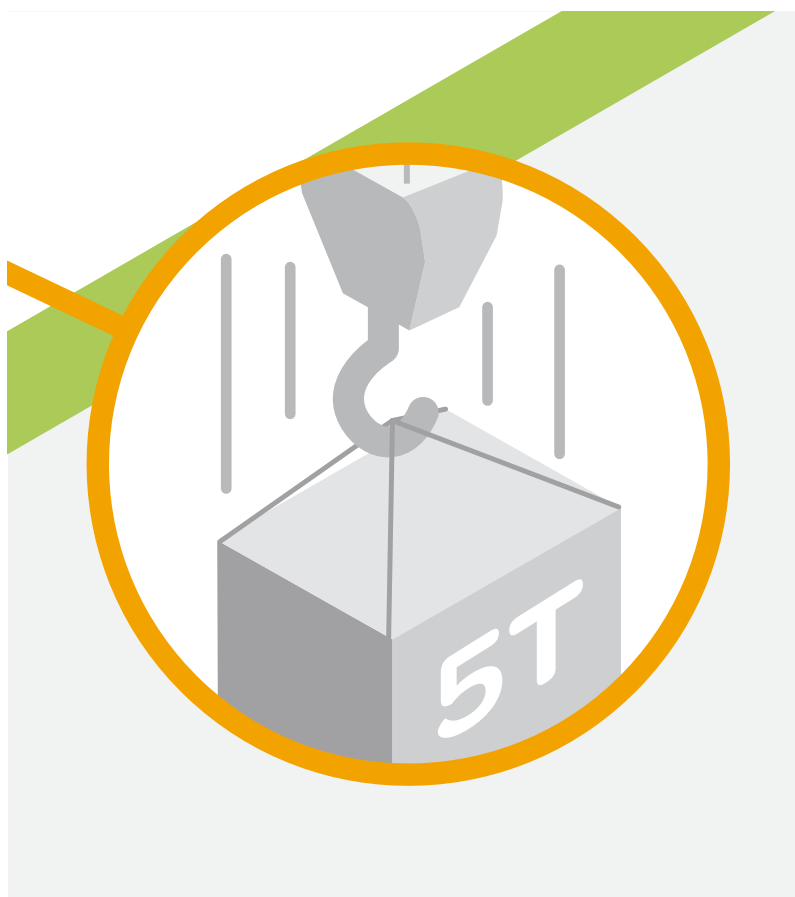
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Overload control

Prevent risk conditions due to overloading.

The overload function prevents mechanical overload for machine safety and durability. Taking into account the weight of the load through the hoisting drive's current level, this function is able to stop the ascending movement in the event of an overload and lowers it until the load reaches the floor.



Benefits

Reduce risks

- Prevent the load from falling and/or the crane from toppling over.

Increase equipments protection

- Prevents damage to the gearbox and motor.

Save production time

- Event reset is automatically generated by torque measurement or by calculation of travel distance.

Easy to install and adjust

- No additional sensors or external devices are needed.

Operating principle

The overload function is based on two sub-functions: the first detects the overload and the second resets the alarm. Each time an upward movement is started, the overload supervision function block determines the maximum load limit that corresponds to an equivalent torque level in the hoist drive.

When an overload is detected, the reset function is triggered according to the selected reset mode using torque measurement or by calculated travel distance.

Characteristics

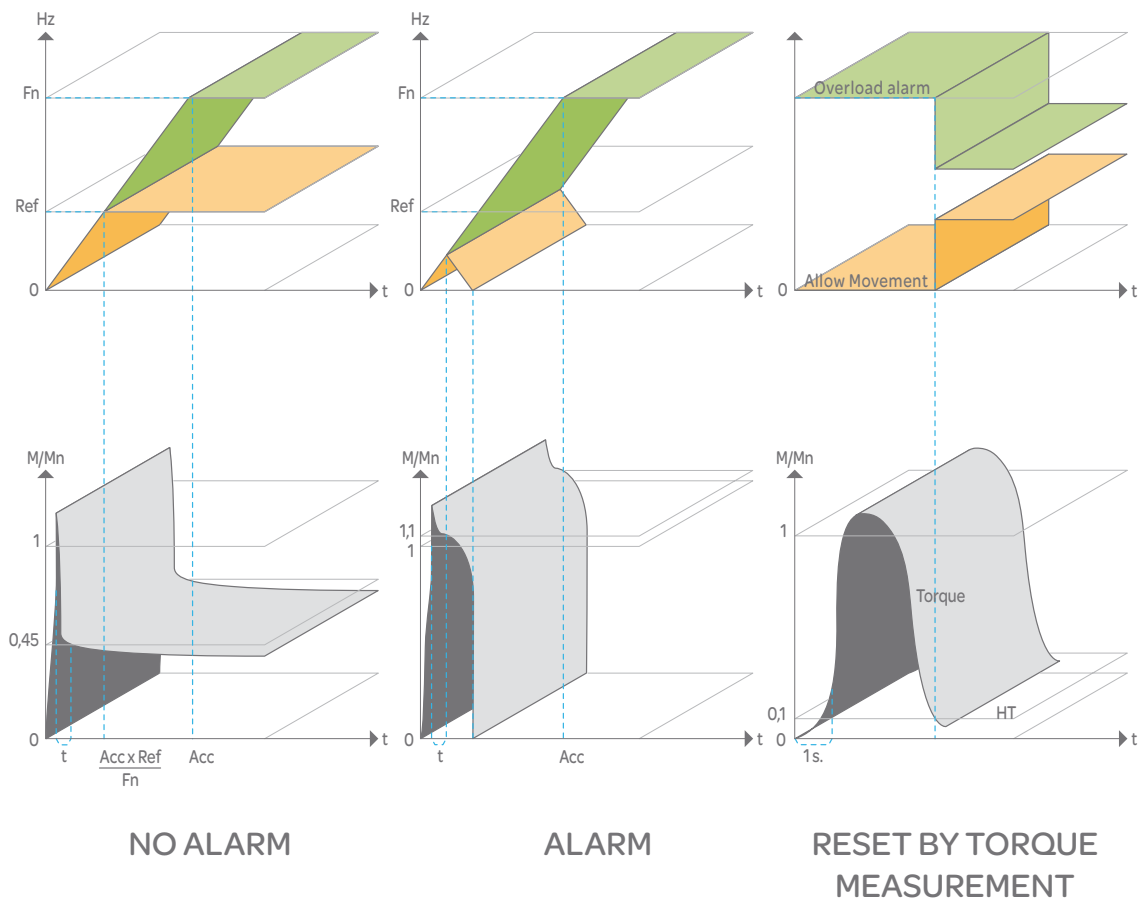
- Up movement is disabled until the condition is reset
- Error detection using torque measurement takes into account an adjustable filter time.
- No sensors or external devices are needed
- The reset function is automatically triggered by selecting from one of two reset modes:
 - Torque measurement
 - or
 - Distance travel using an Encoder or Estimating the distance traveled

Typical applications

- Self-erecting cranes
- Tower cranes

Typical architectures

- Simple hoisting Compact / Hardwired / Logic controller / Zelio Logic
- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC



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Speed optimisation and rope slack

Increase productivity, protect equipment and reduce risk.

The speed optimisation function reduces the work cycle time on the hoisting movement. It allows operation at constant power in order to reach a higher speed. The rope slack function is used to prevent high speeds on the hoisting motor when the rope is slack. At the same time, it prevents overlapping of the rope on the motor drum when the handling tool has been set down and the rope is too slack to be unrolled properly.

Benefits

Save production time

- Reduce working cycle time for hoisting movements according to the weight of the load.

Reduce risks

- Avoid startup or shutdown at high speed when the rope is slack.

Increase equipment protection

- Protect the equipment by preventing overlapping of rope on the hoisting motor drum.

Easy to install

- No additional sensors or external devices are needed.



Operating principle

Speed optimisation

The maximum permissible speed is calculated by the drive during a speed step that is set. The drive can measure the weight of the load by torque measurement and define the new speed reference. Following the measurement, the drive enters Speed Optimisation mode. During the Speed Optimisation, the drive monitors the torque cyclically. If the torque value exceeds a certain set value in percentage, the drive returns to a nominal predefined speed value.

Rope Slack

If the torque falls below a certain set value (less weight than handle tool) the rope slackens. In this case, the drive changes to measure speed of both up and down movement. It allows unrolling the rope for maintenance reasons. At the same time, it helps to prevent against rope rolling at high speed when it is still slack and helps prevent shocks to the load that can lead to unsafe conditions.

Typical application

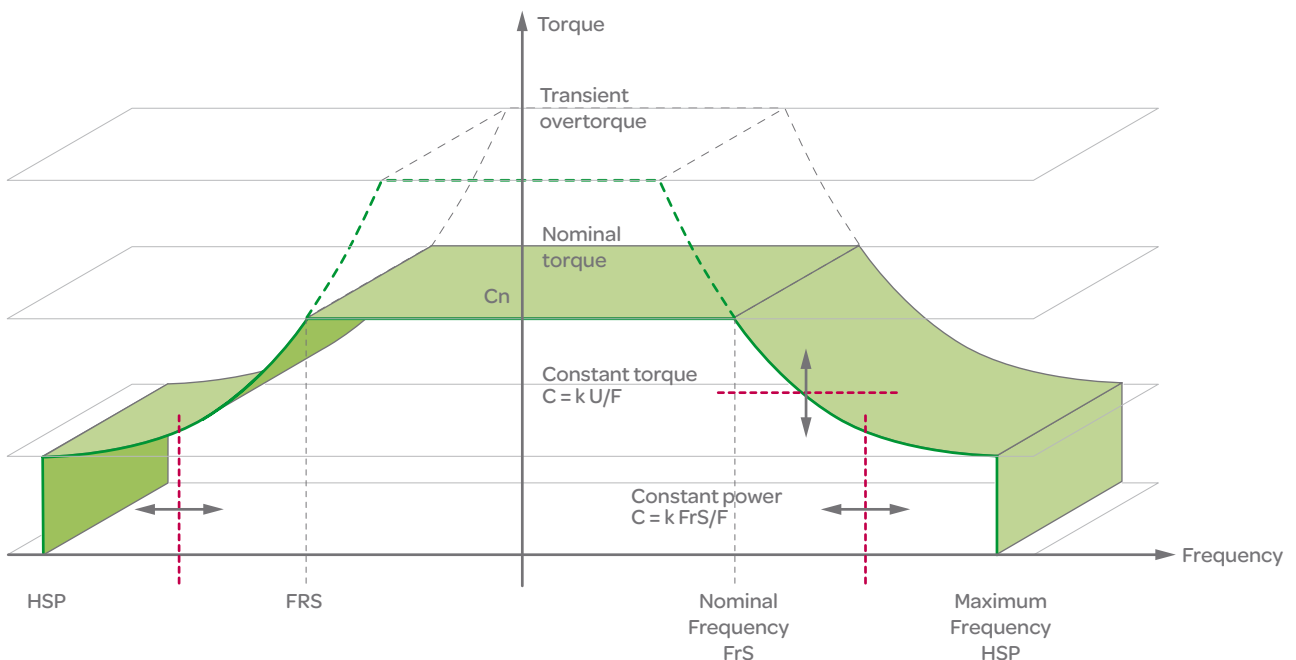
- Tower cranes

Typical architectures

- Optimised hoisting
Compact / CANopen /
Drive controller /
ATV-IMC

Characteristics

The Speed Optimisation and Rope Slack function is based on the flexible control ATVIMC or M238 with ATV71 drive and/or an ATV312 by CANopen field bus. No extra sensors or external devices are needed.



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Smooth slewing

Improve load positioning accuracy and increase crane efficiency while reducing risk.

This function provides smooth and accurate movements on crane slewing to position the load precisely on the target. This function avoids jerking due to over-torque and inertia throughout the slewing movement.

Benefits

Save production time

- Reduce working cycle time and increase positioning precision by avoiding load sway.

Increase crane service life

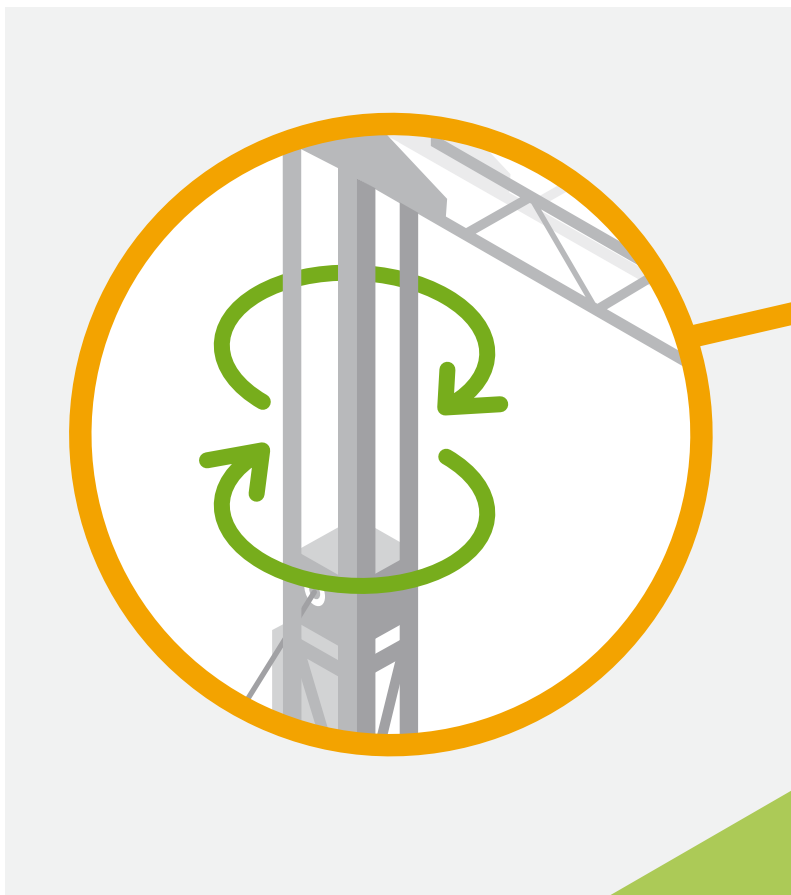
- Reduce mechanical shocks and stress on the crane mechanism and structures thanks to torque adaptation on slewing movement.

Reduce risks

- Prevent excessive and dangerous load swaying.
- Reduce operator stress and fatigue that could lead to errors.

Easy to install

- No additional sensors or external devices are needed.



Operating principle

On starting a slewing movement of the jib, it is necessary to overcome the inertia of the jib. There is always a chance of an over-torque (during start) or over-speed (during stop). To prevent this over-torque or over-speed, it is necessary to control the acceleration and deceleration ramps.

The function influences the acceleration and deceleration of a slewing drive using two methods:

- **Frequency based method:**

The acceleration and deceleration time is adjusted based on the varying frequency level during the acceleration and deceleration.

- **Torque based method:**

The acceleration and deceleration time based is adjusted on the varying torque level during the acceleration and deceleration.

Characteristics

Smooth slewing is based on controller inside integrated on ATV71 drive.

Acceleration:

During acceleration, the acceleration parameter is selected from three pre-defined acceleration values (ACC1, ACC2 & ACC3) as the actual frequency reaches threshold frequency1, frequency2 and frequency3 respectively for frequency based method or as the actual torque reaches the thresholds torque1, torque2 and torque3 respectively for torque based method.

Deceleration:

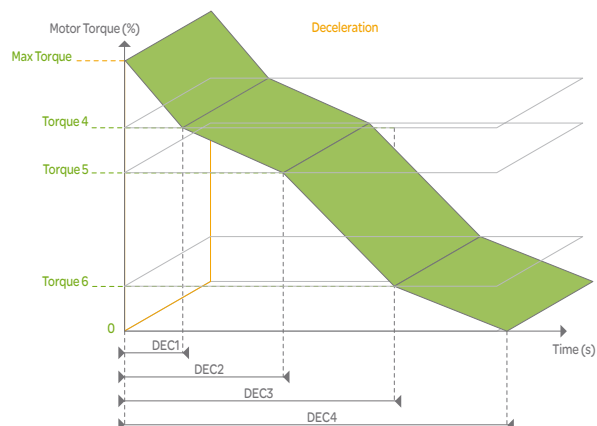
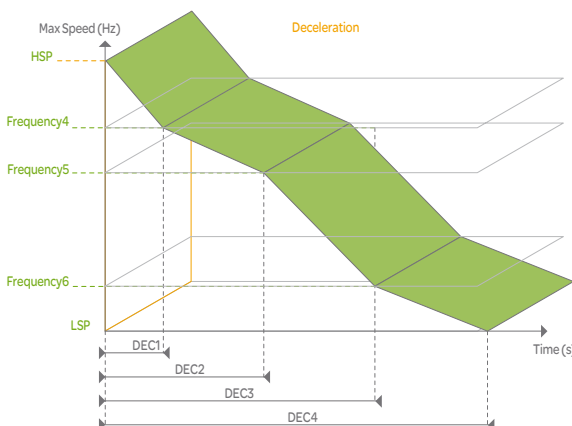
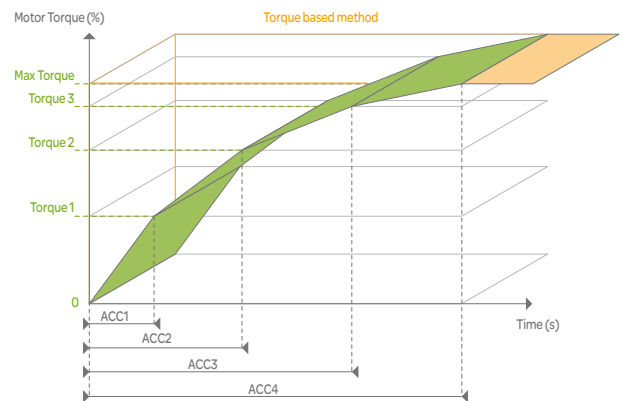
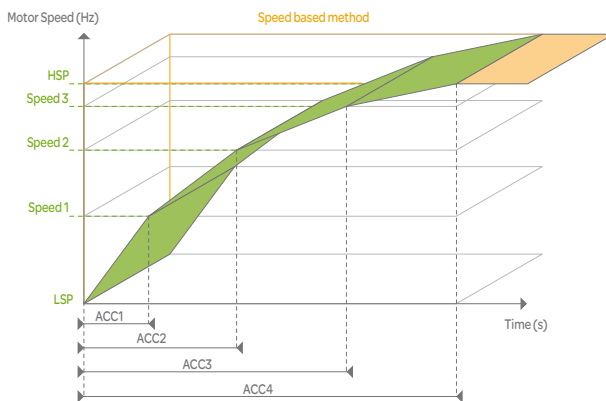
During deceleration, the deceleration parameter is selected from three pre-defined deceleration values (DEC1, DEC2 & DEC3), as the actual frequency reaches threshold frequency4, frequency5 and frequency6 respectively for frequency based method or as the actual torque reaches the thresholds torque4, torque5 and torque6 respectively for torque based method.

Typical application

- Self-erecting cranes

Typical architectures

- Optimised hoisting Compact / CANopen / Drive controller / ATV-IMC



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Load overspeed control

Increase protection of crane equipment and reduce risks.

Internal faults can generate load slipping which can lead to an increase in load speed and associated risk. Load overspeed control is based on a sensor and a controller. When the nominal speed is exceeded, the controller must trigger an emergency stop and the function sends an alarm to control the situation.

Benefits

Reduce risks

- Prevent the load from falling.

Increase equipment protection

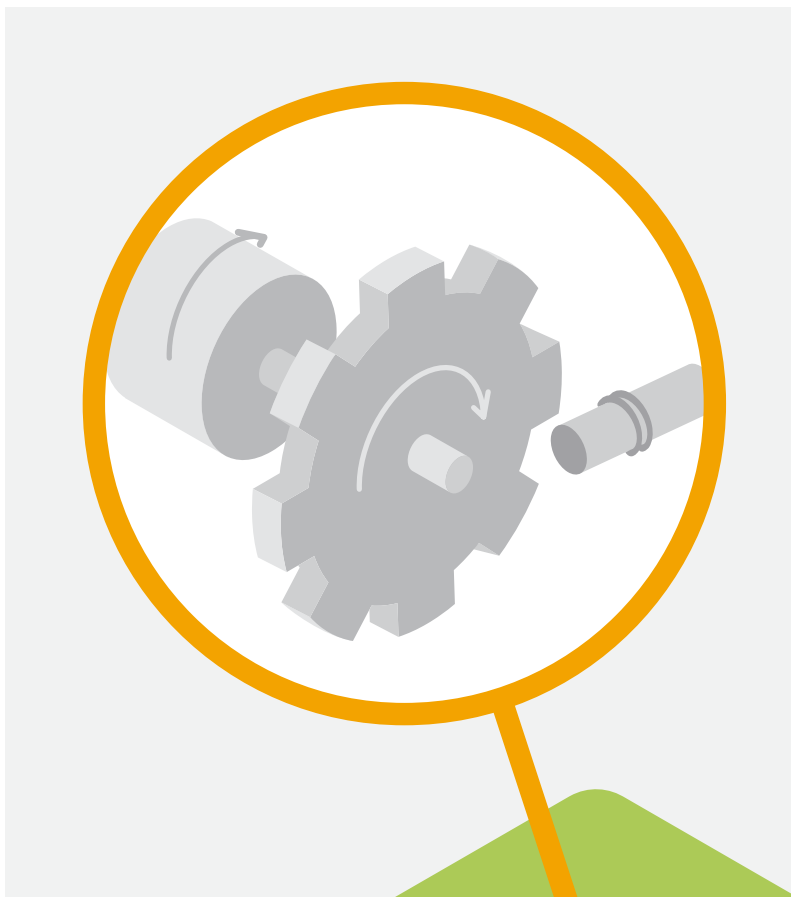
- Prevent damage to the gear box and motor.

Optimised and compact installation

- A dedicated device is not required; the same controller can be used for several functions.

Complete diagnostic

- The most recent overspeed events, with time and date, are recorded as part of the preventive maintenance and monitor.



Operating principle

The objective is to control the nominal speed of the load. The controller must initiate an emergency stop when the speed value is over 110% of threshold speed selected in each movement direction.

Characteristics

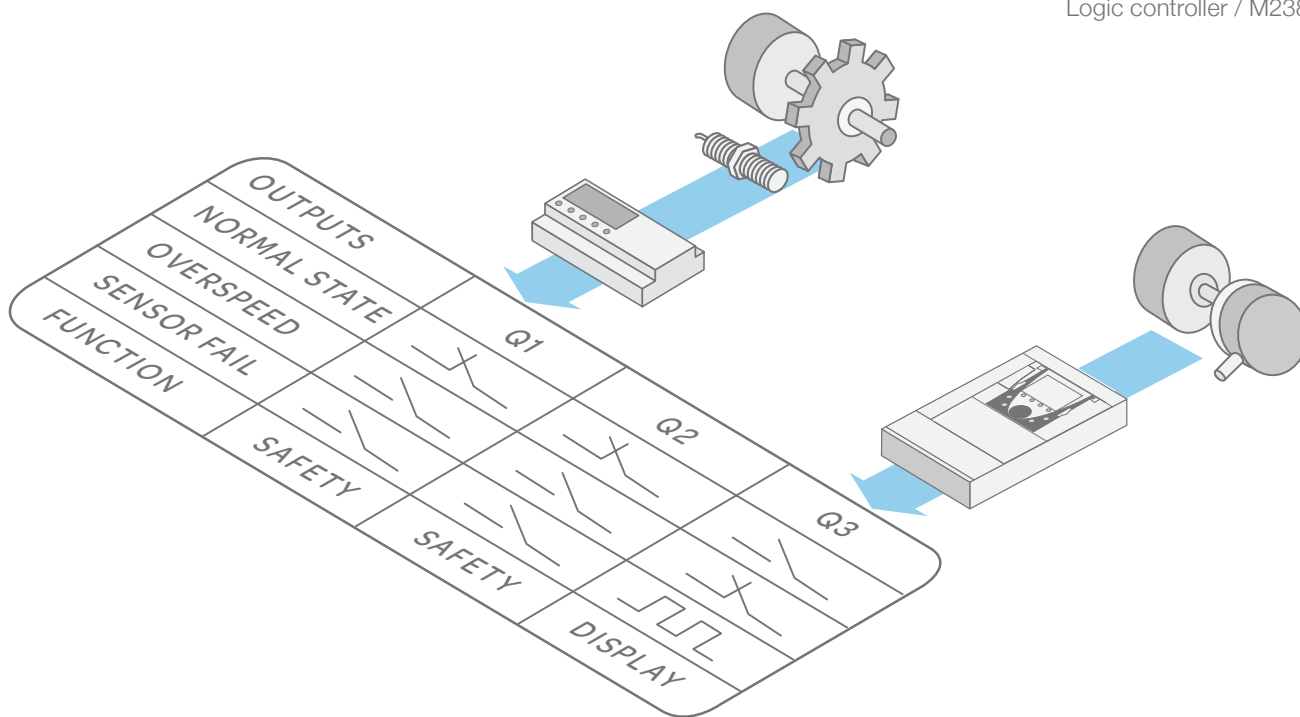
- The motor speed signal comes from a proximity sensor. It detects the metal cam wheel linked to the drum of the hoisting rotation axis.
- An encoder can be used instead of a proximity sensor; it should be installed in the drum of the hoisting rotation axis
- Time and date of the most recent events are recorded for maintenance diagnostic

Typical applications

- Overhead travelling cranes
- Gantry cranes

Typical architectures

- Simple hoisting Compact / Hardwired / Logic controller / Zelio Logic
- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC
- Optimized hoisting Compact / CANopen / Logic controller / M238



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Anti-sway (sensorless)

Improve load positioning accuracy and increase crane efficiency while reducing risk.

The anti-sway function prevents load sway on the crane due to acceleration and deceleration of the trolley and the bridge. Through the operator assistance function and the predefined parameter, dynamic correction is automatically carried out with readjustment.



Benefits

Save production time

- Reduce working cycle time and increase positioning precision by preventing load sway.

Increase crane service life

- Reduce mechanical shocks and stress on the crane mechanism and structures due to over-correction and pulsating during positioning.

Reduce risks

- Avoid an excessive and dangerous load swaying.
- Reduce operator stress and fatigue as a source of error.

Easy to install

- No additional sensors or external devices are needed.

Operating principle

The main object is to control the load sway without additional sensors (use of encoder only when higher accuracy is needed). This function works simultaneously on 2 axis (including trolley, bridge of crane and hoisting for position feedback).

It uses the same electrical operator interface without modification to wiring and takes control to manage the entire system via an CANopen field bus.

Characteristics

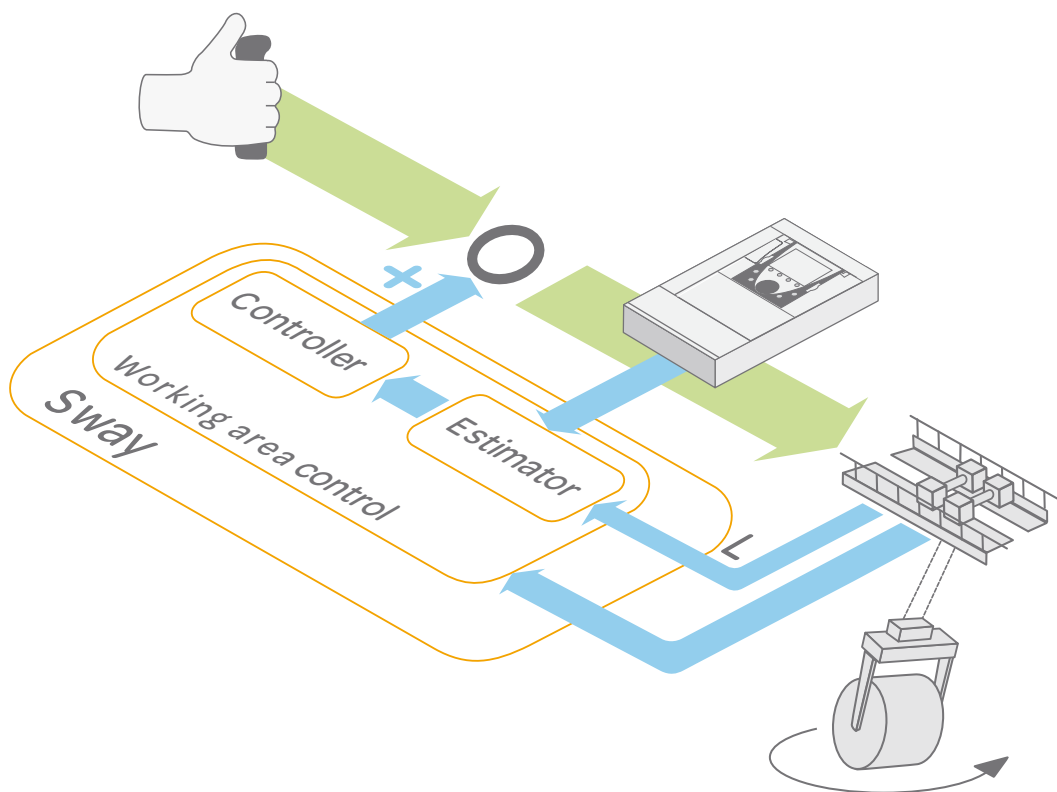
- **Estimator:**
Load sway estimation based on an adaptive model using drive speed, internal signals and cable length
- **Controller:**
Adaptive continuous controller providing anti-sway correction to the operator command
- **Working area control:**
Deactivation of anti-sway function when leaving working area.

Typical applications

- Overhead travelling cranes
- Gantry cranes

Typical architectures

- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC
- Optimized hoisting Compact / CANopen / Logic controller / M238



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Monitoring data storage

Preventive maintenance and monitoring data logging of operating parameters.

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Benefits

Optimisation of safety equipment service life

- Maximum use of critical equipment such as the gearbox via automatic calculation of the working safety period.

Prevent problems from becoming maintenance issues

- Reliable and up-to-date crane diagnostics through the historical data maintenance.

Save maintenance time

- By determining the origin of the problem before solving it.



Operating principle

Maintenance data storage:

For acquiring, warning and recording the most relevant maintenance data. The goal is to provide efficient maintenance information coordinated with the crane's operations. This function calculates the working safety period by counting the working hours and taking into account the load weight which was hoisted during these working hours.

Event warning and recording:

Notification and recording of critical events such as overload, overspeed, load slipping, and encoder faults to enable the complete diagnostic of the crane.

Improper crane operations data register:

This detects operations such as pulsating or backtracking that can impact the service life of the equipment and increase maintenance service time.

Characteristics

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While the main movement controlled is hoisting, these function blocks can control all movements simultaneously.

• Maintenance data storing:

- Working hours and number of operations by movement
- Working hours at 300 and 600 operations per hour
- Working Safety Period (WSP) by using load cell or drive estimation

• Event warning and recording:

- Overload and overspeed recording: last 20 events, including, date and duration
- Load slipping (accumulated events)
- Encoder fault (accumulate events)
- Configurable alarm for all these events

• Improper crane operations data register:

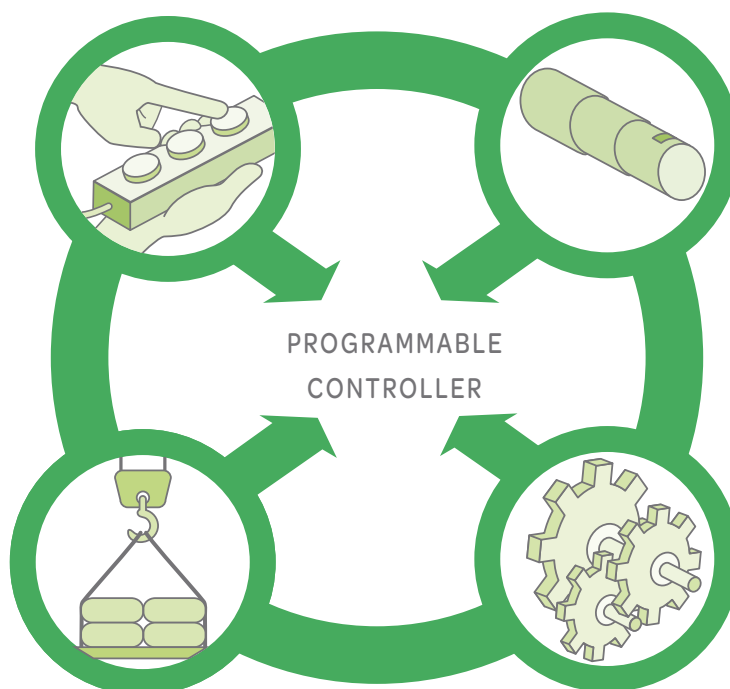
Pulsating and backtracking register for all movements selected

Typical applications

- Overhead travelling cranes
- Gantry cranes

Typical architectures

- Simple hoisting Compact / Hardwired / Logic controller / Zelio Logic
- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC
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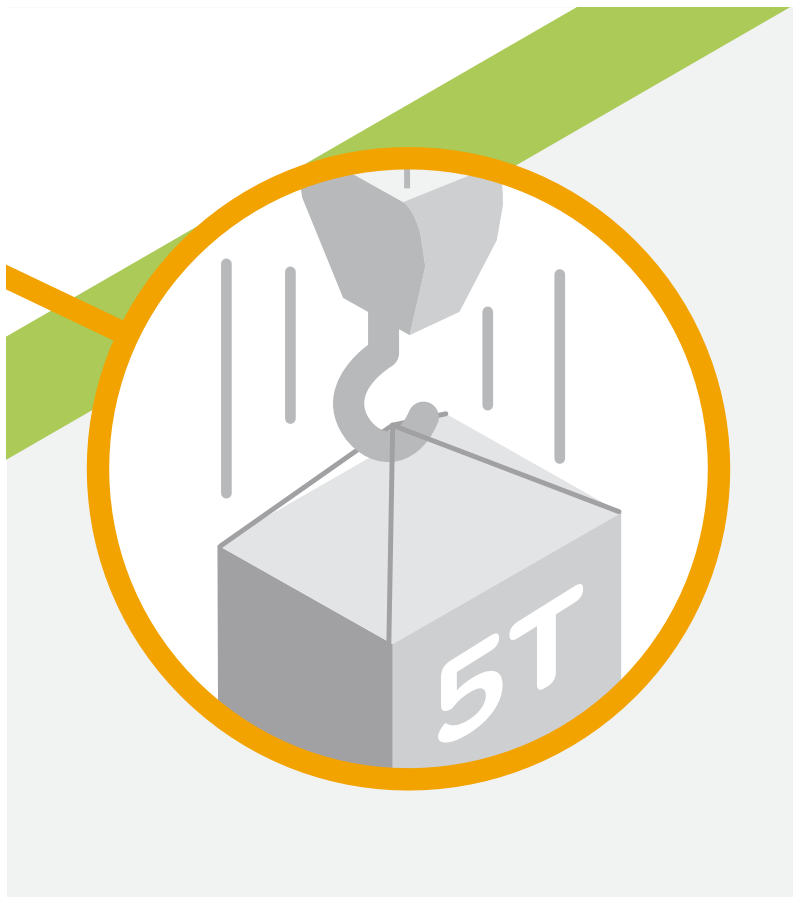
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Overload control

Prevent risk conditions due to overloading.

The overload function prevents mechanical overload for machine safety and durability. Taking into account the weight of the load through the hoisting drive's current level, this function is able to stop the ascending movement in the event of an overload and lowers it until the load reaches the floor.



Benefits

Reduce risks

- Prevent the load from falling and/or the crane from toppling over.

Increase equipment protection

- Prevents damage to the gearbox and motor.

Save production time

- Event reset is automatically generated by torque measurement or by calculation of travel distance.
- Only 5 parameters are needed.

Easy to install and adjust

- No additional sensors or external devices are needed.

Operating principle

The overload function is based on two sub-functions: the first detects the overload and the second resets the alarm.

Each time an upward movement is started, the overload supervision function block determines the maximum load limit that corresponds to an equivalent torque level in the hoist drive. When an overload is detected, the reset event function is triggered according to the selected reset mode using torque measurement or by calculated travel distance.

Characteristics

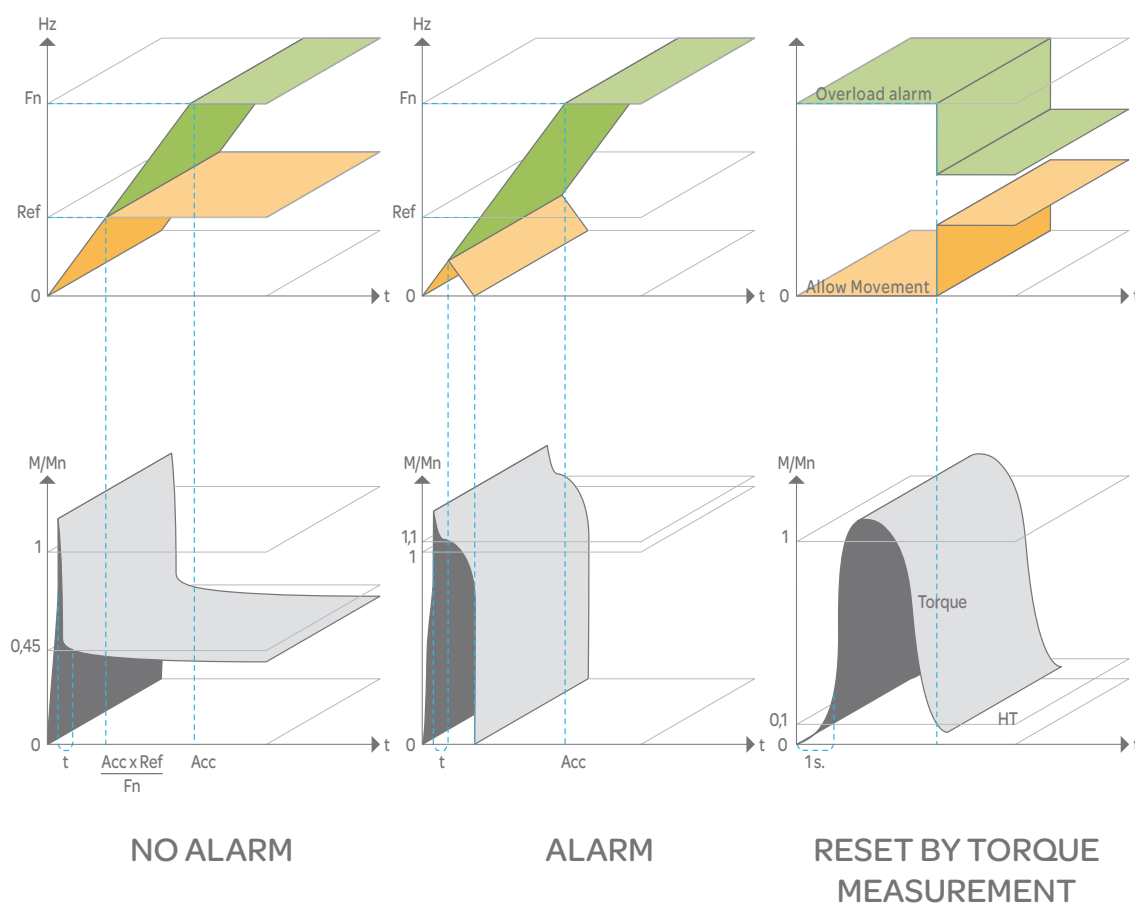
- Up movement is disabled until the alarm is reset
- Error detection using torque measurement takes into account an adjustable filter time
- No sensors or external devices are needed
- Reset event is automatically generate
- The reset incident function is automatically triggered by selecting from one of two reset modes:
 - Torque measurement
 - or
 - Distance travel using an Encoder or Estimating the distance traveled

Typical applications

- Overhead travelling cranes
- Gantry cranes

Typical architectures

- Simple hoisting Compact / Hardwired / Logic controller / Zelio Logic
- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC
- Optimized hoisting Compact / CANopen / Logic controller / M238



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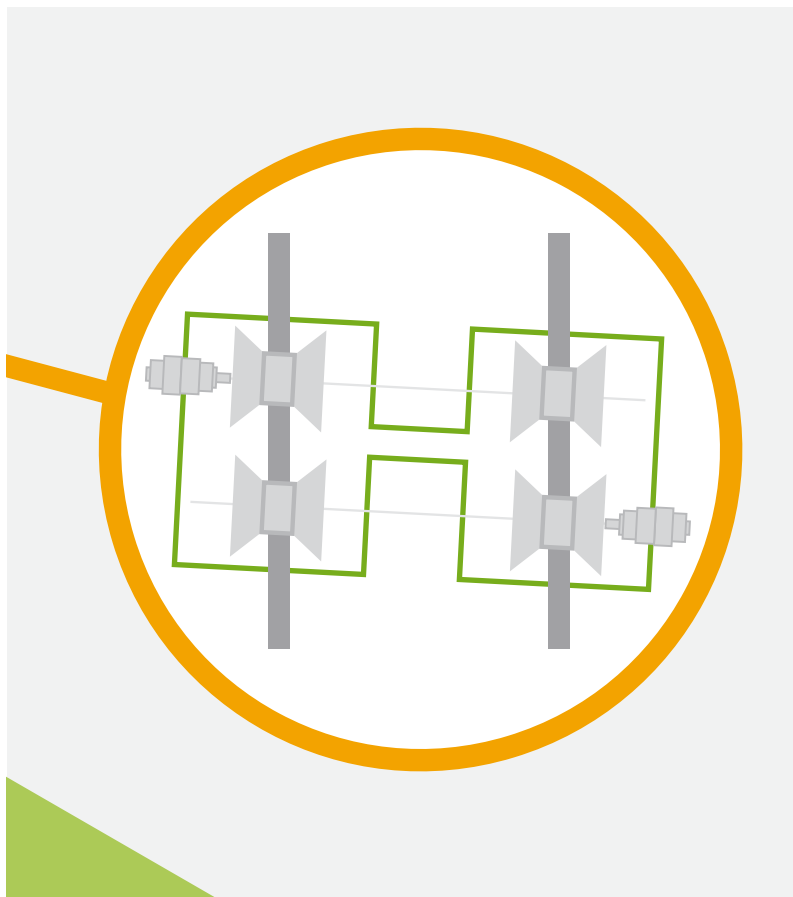
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Anti-crab

Protect equipment and increase efficiency and crane service life.

The anti-crab function is an automatic realignment system which help prevent crane skew and crab drift related to cranes with long spans. It maintains the path and the track parallel between the two bogies independent of load position or initial crane assembly.



Benefits

Increase efficiency and crane service life

- Reduce wear and tear on rollers.
- Reduce mechanical vibrations.
- Prevent amble on plates and damaged welding.

A complete solution

- Keep crane axis path in the same direction as the track axis path (anti-skew).
- Prevent the crane from moving away from its track (anti-drift).

Consideration of internal and external factors

- Absence of undercarriage motor synchronisation on start/stop operations.
- Incorrect initial position of wheel mounting.
- Bridge motion with no centred load.
- Transversal load sway.

Easy to install

- Use of only two proximity analogue sensors in one of the bogies and controller card integrated in the drive.
- Encoders or others more sophisticated sensors are not needed.

Operating principle

Anti-skew: when the crane is perfectly aligned with the track, both sensors have a similar output value because they are at the same distance. When the crane starts moving, it crosses the track and detects output with different values. With these new values and movement direction, the system determines which drive must be reduced in speed. The speed is reduced until both sensors have the same value, then the system recognises the crane path is now parallel to the track.

Anti-drift: some drift incidences can arise such as bad sensor mounting or a badly adjusted detector due to a posterior crash, or if a screw grows weak or due to wheel slippage. Also the cause can be some wheel slipping. In these cases, the crane may shift laterally, thus increasing both detector values. When this happens the system generates a skew to move crane to right position, correcting it after to be realigned.

Characteristics

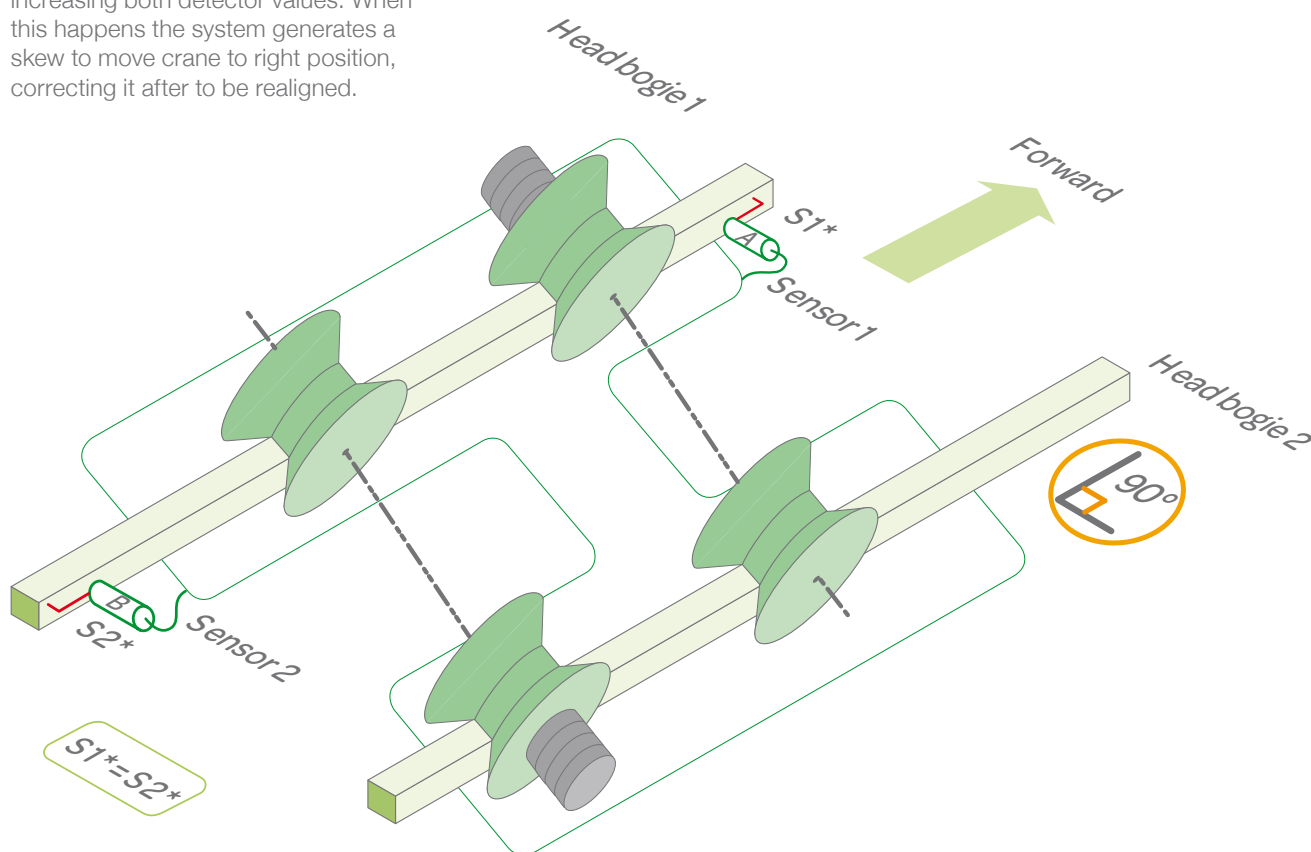
- A bidirectional regulation master-slave provides choice and changes which drive must reduce speed of translation motor to maintain the parallelism of the undercarriages on the track rails during bridge translation movement, thus preventing crossover of the crane
- An intensity control on acceleration and deceleration ramp is performed to reduce the sway of the suspended load
- This function is based on drive controller or logic controller: ATV 71 + Integrated Machine Control (ATV-IMC) used on the hoisting movement or M238 logic controller managing the complete crane. It communicates with both Altivar drives using on translation bridge via CANopen field bus.

Typical applications

- Overhead travelling cranes
- Gantry cranes

Typical architectures

- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC
- Optimized hoisting Compact / CANopen / Logic controller / M238



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Limit switches management

Increase protection of crane equipment and reduce risks.

This function manages the motion of the bridge or trolley of an industrial crane along an axis with a cross stick limit switch using two points of detection on each side. It defines the stop and slow point by setting up the distance parameter. You can also use it as an anti-collision function by using a photoelectric sensor instead of limit switch.

Benefits

Reduce risks

- Limit the working zone.
- Prevent breakdown or load dropping.

Increase equipment protection

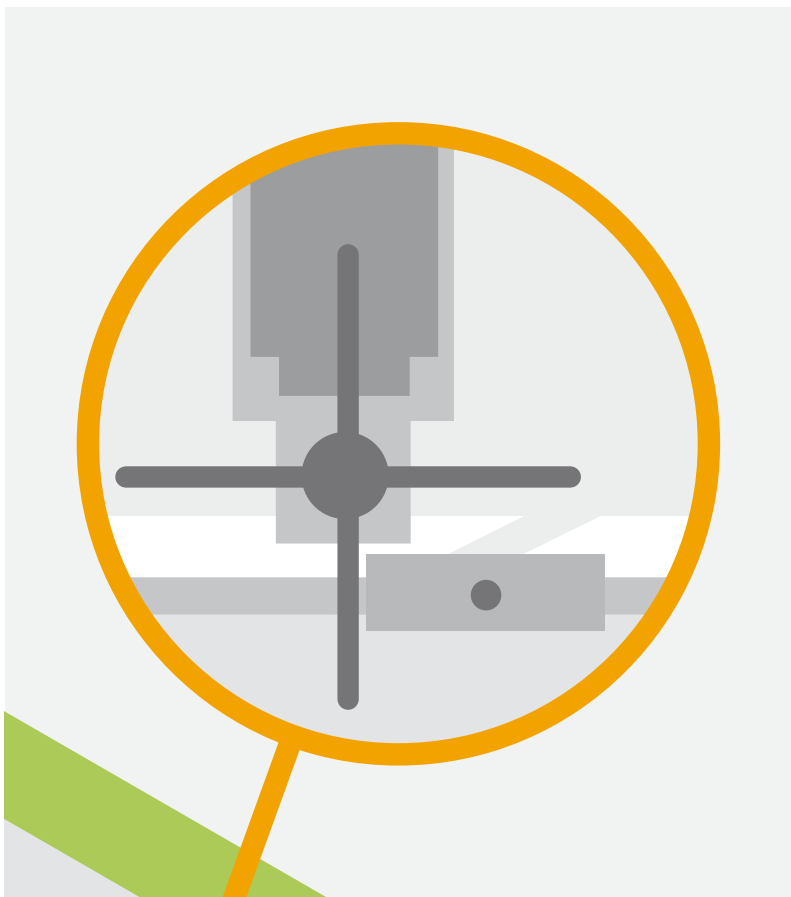
- Prevent damage to crane equipment.

Easy to install

- Save commissioning time.

Diagnostic display

- The limit switch status can be displayed on the HMI.



Operating principle

- This function manages the motion movement along an axis with low speed and stop sensors.
- Positioning can be performed in one or both directions
- The sensors can be disabled so the object can pass the stop sensor and proceed further, if required
- When the moving object is stopped on the stop sensor of one direction, it can be moved in the opposite direction
- The positioning can be performed based on distance
- For testing purposes, the stop position can be disabled within software so the object can pass by the slow sensor and the crane will be stopped by the buffer

Characteristics

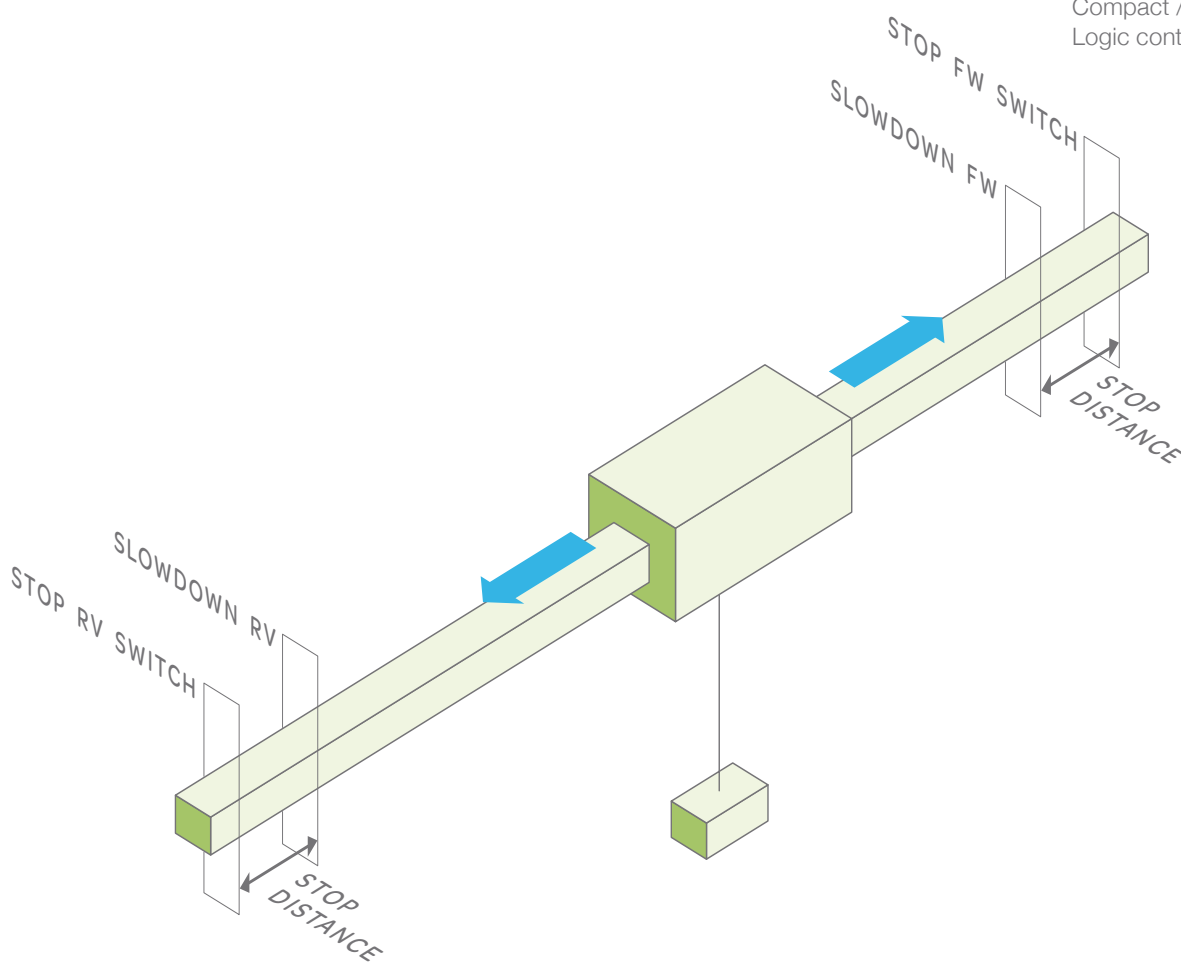
The limit switch function is based on a cross stick limit switch and smart relay or drive controller.

Typical applications

- Overhead travelling cranes
- Gantry cranes

Typical architectures

- Simple hoisting Compact / Hardwired / Logic controller / Zelio Logic
- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC
- Optimized hoisting Compact / CANopen / Logic controller / M238



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Hoisting position synchronisation

Increase production and equipment protection while reducing risk.

The goal of the hoisting position synchronisation function is to provide the same positioning of the two handling tools that are hoisting the load simultaneously. This hoisting synchronisation is managed by the master-slave function that keeps an initial master slave position difference at a constant value. The master-drive is used as the reference and the coordinated action is sent to the slave drive over the CANopen field bus.

Benefits

Save production time

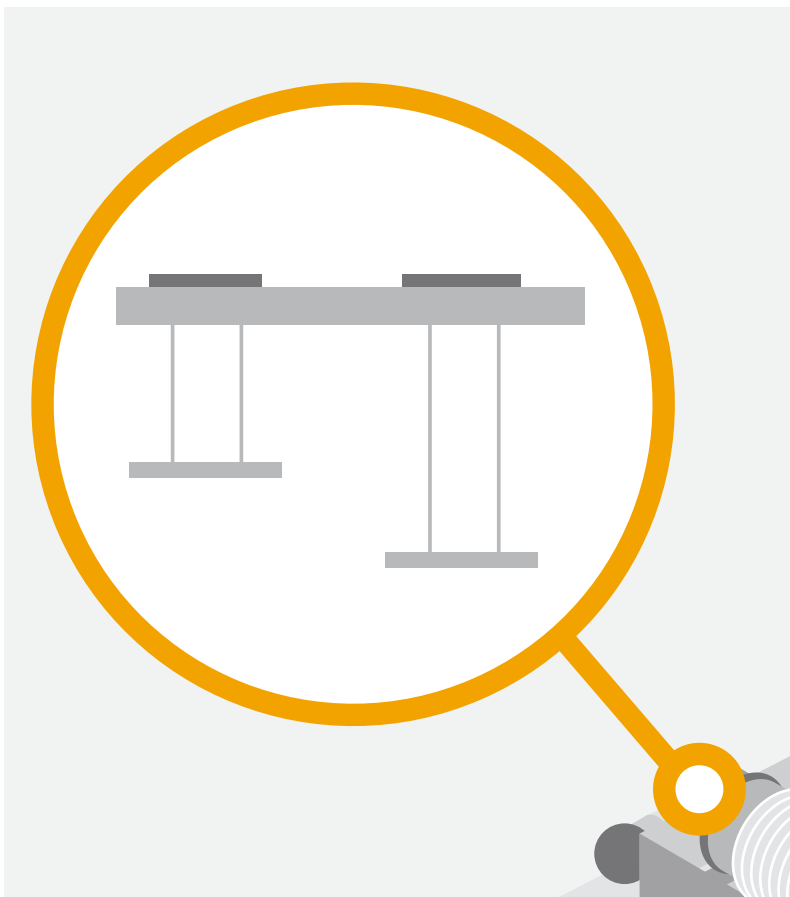
- Reduce working cycle time by automatically synchronizing the hoisting movement of trolleys

Reduce risks

- Prevent breakdown or the load from falling.
- Avoid excessive and dangerous load unbalancing.

Easy to install

- No additional devices are needed.



Operating principle

There are three operating modes:

- Independent operation
- Synchronous operation
- Slave stand alone operation

When in synchronous operation mode, the application will run the position synchronisation function.

This control algorithm to provides the same positioning of the slave handling tool to match the master drive. This means it keeps an initial master-slave position difference at a constant value (this can be zero).

Synchronisation is triggered by activation of the synchronisation command.

Synchronisation of lifts is managed by the controller inside card. The master drive uses a frequency reference. This coordinated action is sent as a reference to the slave drive over the CANopen field bus.

Characteristics

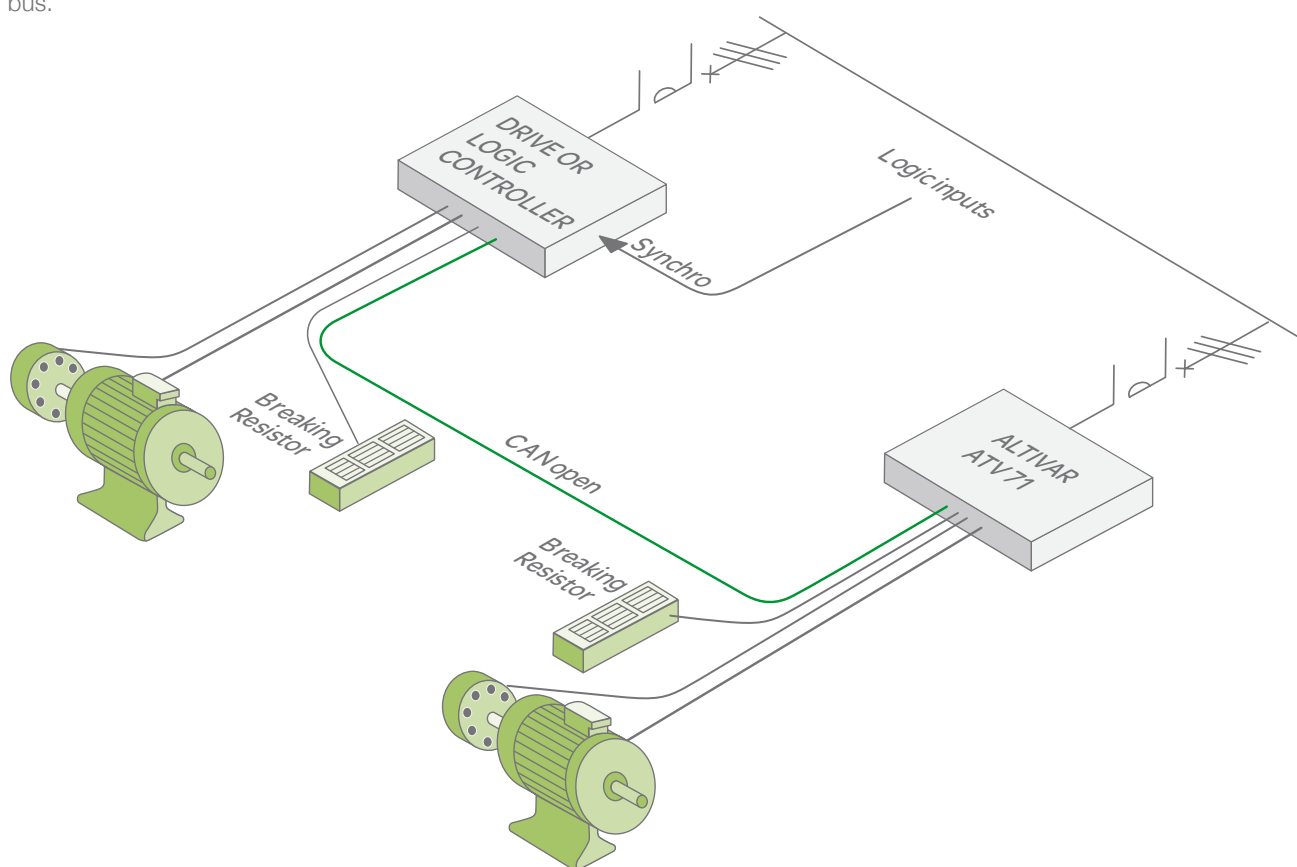
- The Hoisting position synchronisation is based on the flexible control Drive controller or Logic controller
- Using a Drive controller you can display all information required by using either an integrated Keypad display of ATV71 drive or with a Magelis XBT connected to the with ATV71 over a Modbus link.
- Using a logic controller you can display all information required by using a Magelis XBT connected on the logic controller.

Typical applications

- Overhead travelling cranes
- Gantry cranes

Typical architectures

- Optimized hoisting Compact / CANopen / Drive controller / ATV-IMC
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