



**Instruction manual
of baggage transport system
Dimark Air Pro**

1. Steering system's organization

Steering algorithm was implemented in a Beckhoff driver with a TwinCAT system, which drives and monitors an object's work by a net of sensors and executive components.

A central point of a steering system is a main steering cabinet, located nearby a transport line. The steering cabinet consists of following steering elements and electric apparatus:

- a master switch;
- a feeder 24VDC;
- safety modules (emergency stop circuit);
- contactors, inverters and motor safety for electric drives;
- PLC driver with infeed and outfeed digital and communication modules;
- control panel (placed at an elevation of a steering cabinet);
- clamp slats.

The following components are placed on a door of a steering cabinet:

- master switch

A power is switch on in an "ON" position.

- emergency switch

Pushing in a button entails an emergency stop of a driver's work. A restart of a work is possible by pressing out a head of a button and deleting an alarm, reported by a panel.

- Reset/ Start button

ESR safety alarms are deleted by this button. The operation is demanded during a start- up procedure and after detecting an active emergency switch. An active ESR alarm is signaled by its enlightening. An additional function of the button is to confirm an inactive alarms of a PLC driver and to start- up the process.

- Control panel

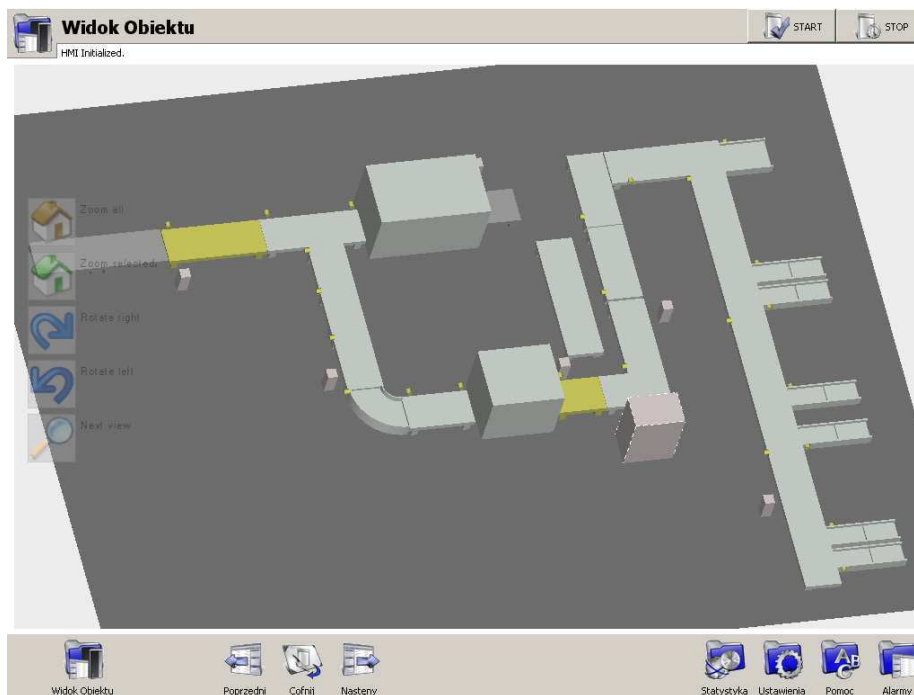
LCD touch screen enables an interactive device service (HMI- Human Machine Interface).

1.1 Control panel service

Following functions are implemented in the control panel:

- displaying the information about system status;
- parametric service of a steering object;
- handling service mode;
- manual steering of executive components;
- alarm system service (displaying emergency reports and a history of alarms).

After starting- up a steering system, an control panel starts presenting an object in a 3D view:



HMI application window was divided into three functional sections:

- Information heading;
- Navigation strip;
- Operating area.

1.1.1 Information heading

A heading is designated to inform on a current view selection, presented in an operating area:



An icon and an „Widok Obiektu” (“Object view”) description inform on a current function of an object view, selected by an operator. Graphics of an icon and a description are changed according to a selected, demanded function. On the right, there are “START” and “STOP” buttons. Their task is to start and stop a transport process. In a lower part of a heading, reports on recently effected action of a driver, announcements and alarms are displayed.

1.1.2 Navigation strip

An operator chooses a function executed by an operating area by the means of navigation strip buttons:



A strip is placed in a lower part of an control panel. A currently selected button is marked out. As an example, “Settings” („Ustawienia”) function is selected below:



The following functions for an operating area are available:

- Object view;
- Statistics;
- Settings;
- Help;
- Alarms.

The following navigation buttons are placed on a strip:

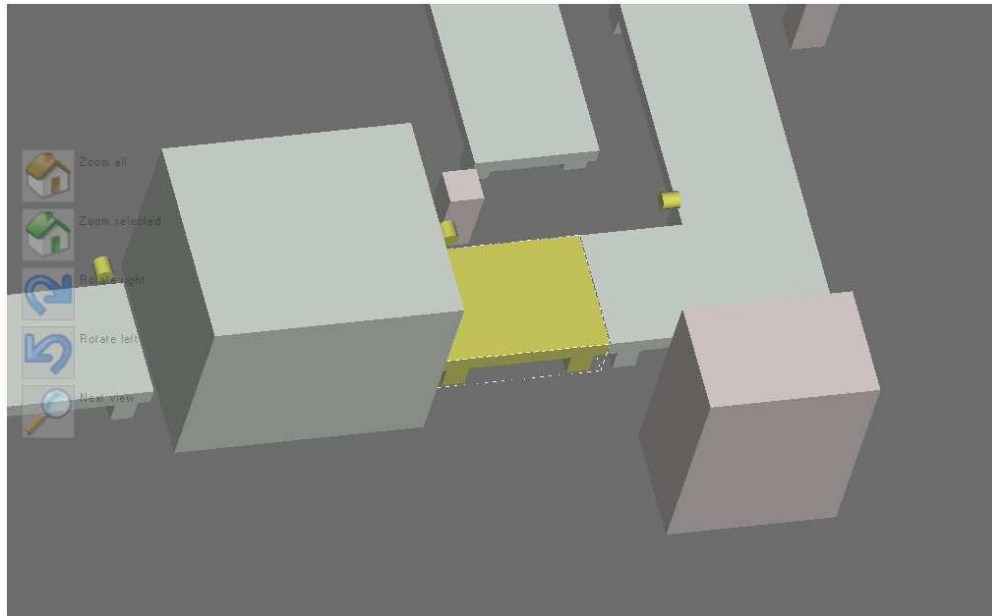
- Back;
- Next;
- Previous;

A selected function determines buttons actions.

1.1.3 Operating area

A content of an operating area depends on a function, chosen by an operator.

An example of “Object view” function in a close-up on a conveyor of a transport line is shown below:



A set of possible modes of an operating area are as follows:

- Object view;
- Statistics;
- Setting;
- Help;
- Alarms.

A mode of a selected operating area is signaled in an information heading by a description and graphics related to a selected button:



1.2 Functions of the control panel





1.2.1 Object view function

An object view function presents an object in a 3D view. An operator may point at an element of a system by a touch screen. A current choice is presented in the view by distinguishing an element, and its name is presented in a heading:



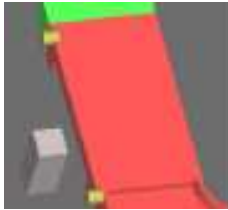
An operating area contains buttons which enable a view parameters change. A change from a current view to another is carried out smoothly. Thanks to an applied animation, an operator may follow a localization of a selected element.

The following object view changes are possible:

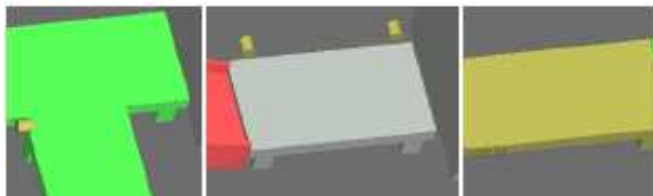
-  The whole object (Zoom All)- the whole object presentation together with a current choice;
-  A selected element (Zoom selected)- an adaptation of a view to dimensions and position of a selected element;
-  Rotations (Rotate Right/ Left)- a rotation of a view in a selected direction;
-  A default view (Next view)- the whole object presentation and selection in its default view.

A present state of particular elements of a system is projected by colours.

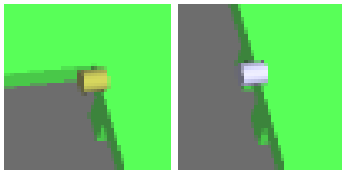
An element for which an alarm's state is active, is red:



A start-up and a proper working is signaled by a green colour, while a grey colour signifies a disconnection. A yellow colour is applied for suspended elements due to an overfilling of a transport system:



An active sensor's state is presented by a yellow colour, an inactive one by a white colour.



A visualization of sensors and motors' states in a real time enables an immediate diagnosis of their efficiency.

It is possible to select other elements of the same type on a navigation strip by navigation buttons. A "back" button select a superior object.

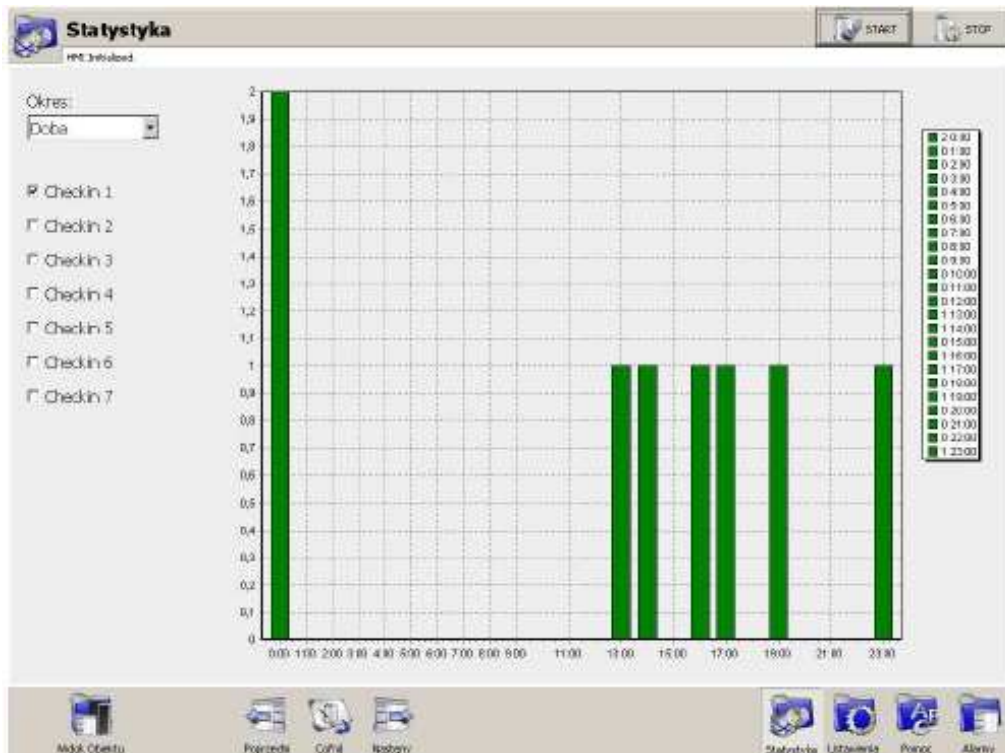
Any other object may be also pointed by a touch panel.



1.2.2 Statistics

A statistic window presents data collected during a system’s work. In the top part of a window, there is a chart which presents a selected type of data. On the left, there is a list which allows to change a time scope of selected data. It is possible to monitor statistics in the following time scopes:

- an hour;
- a day;
- a month;
- a year;
- multiannual.



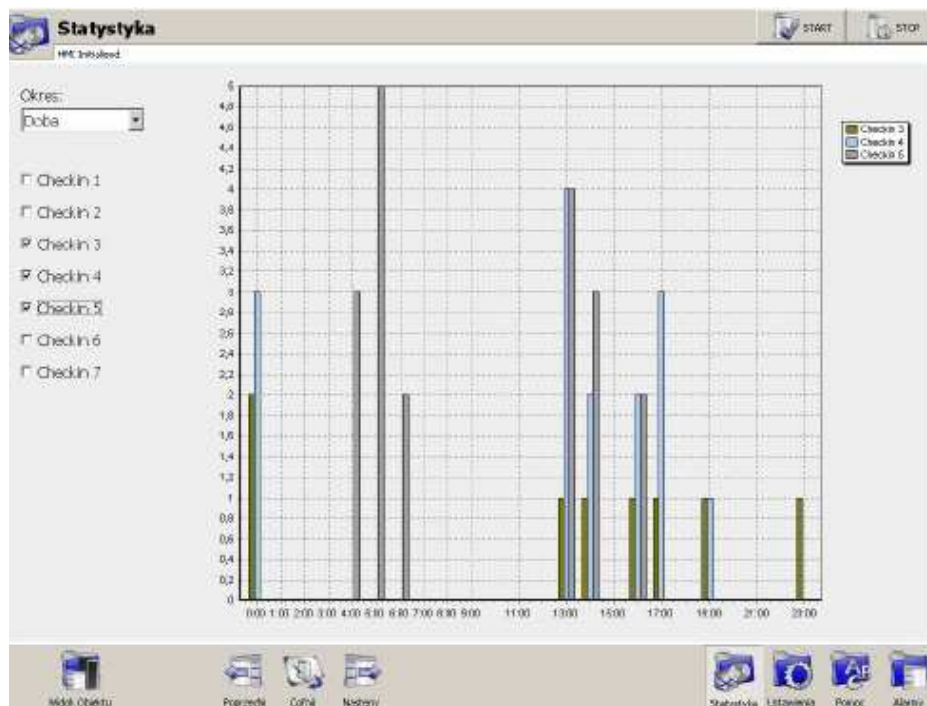
In the above example, statistics for check- in stands were defined. A baggage that leaves a stand is registered in a system of statistics under an adequate position. Collected information are permanently being saved and are not lost while restarting a system or switching –off a feeding. A chart while data presenting, automatically adopts axes’ scales for time and quantity.

The kind of collected information may be defined by a change in settings for sensors in a service mode. Every sensor placed in a transport line may create its own statistics. It is possible to collect information of different kind, depending on a particular sensor location and a mechanical configuration of a transport system.

Examples of kinds of collected statistics may be the following:

- Total quantity of checked-in baggage;
- Scanned baggage by particular scanning device;
- Quantity of baggage transferred to a third level of safety;
- Checked-in baggage in a Bypass mode;
- Statistics for detected radioactivity alarm;
- Quantity of undersized baggage.

There is a register of defined statistics beneath the list. It is possible to choose and present many statistics at the same time. A legend on the right identifies separate groups of data:

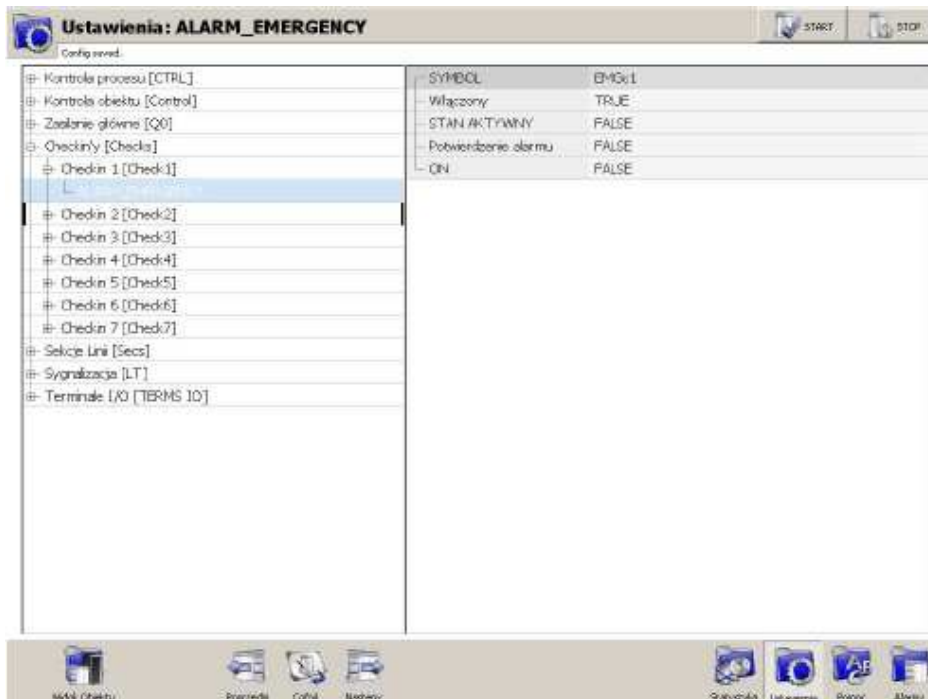


A chart window allows to enlarge or move selected fragments of a chart. To enlarge one should point at a left top corner of a selected area on a chart and pull it to its right bottom part. To reduce it is necessary to do it in a opposite way, from right to left.

A remote access to a system of statistics is possible. An access to Internet and an installation of an adequate application are required. A remote monitoring of work's parameters and statistics are secured by authorization codes.

1.2.3 Settings

A setting window's purpose is to visualize set and current parameters of all elements of a system. These elements occur in the left part of a window and are arranged in functional hierarchy, according to a project of a system. On the right, parameters connected with a selected position are presented. A brighter colour distinguishes setting for which a change in selected value is possible (second level of authorization is required).

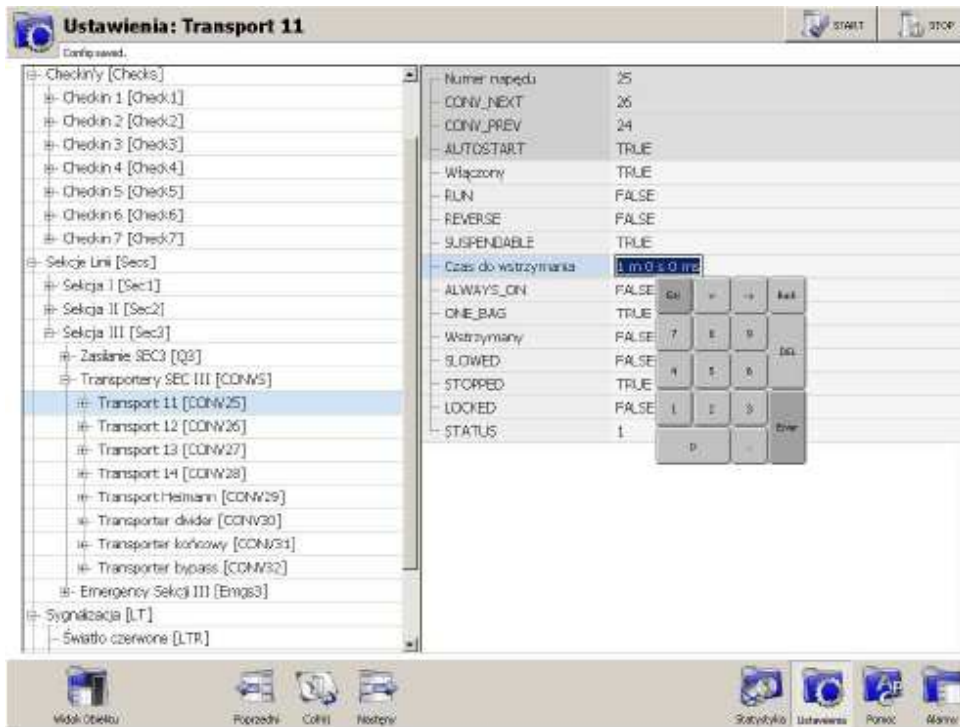


There are three levels of an access to settings. Basic level allows a reading on defined parameters and a previewing of current states of system' s elements.

A change and a record of set parameters is possible on a second level of authorization. An access is reserved by a password. A proper password defines a level of authorization of an operator.



Parameters of particular elements may be edited only in a range set by a manufacturer.

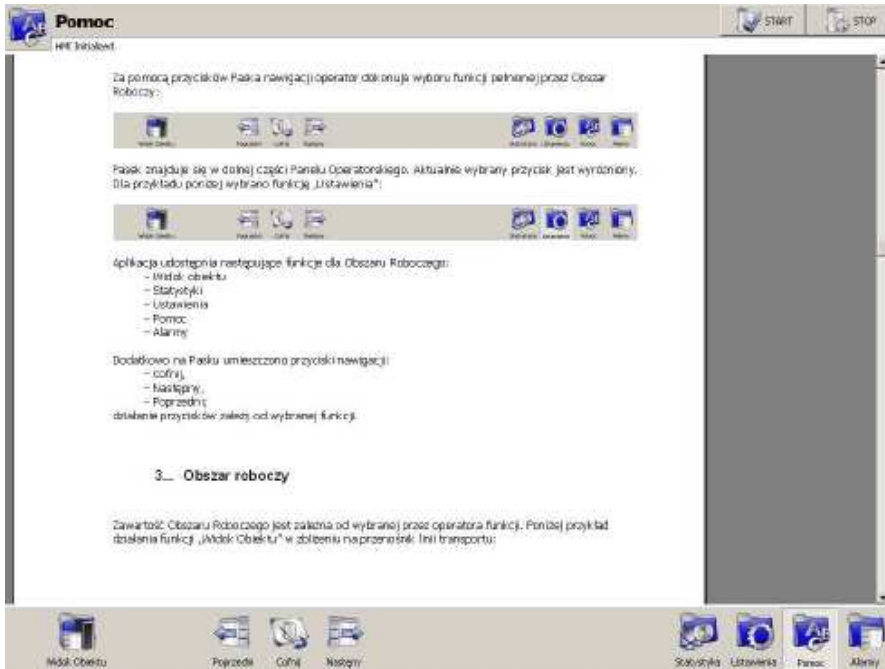


The highest level of an access is preserved for service use by a manufacturer.

Navigation buttons allows to change a selected element. A 'back' button guides to a superior button. In case of a main object choice, a button automatically guides to a object view function.

1.2.4 Help

A 'help' window assures a quick access to an implemented manual for a device:



A navigation of a manual file is possible by the means of rewinding strip in the right part of a window.

A move to other functions of a panel does not change a choice that was made.

Alarms

An ‘alarms’ window allows a reading on reports of events which are being effected in a system. There are three lists of events arranged according to their categories.

PLC alarms:






For every alarm, a time of occurrence and a report text are displayed. A current alarm state (ON position) is also presented, as well as alarms’ confirmation by an operator. Pointing at a report displays a description of a recommended procedure. An inactive alarm may be removed from a list by an acceptance of “ACK” button.

Active alarms are also visible in a object view window, while elements which concern an alarm are shown in red. An element with an alarm is selected and activated by pointing at an alarm’s report and moving to other functions.

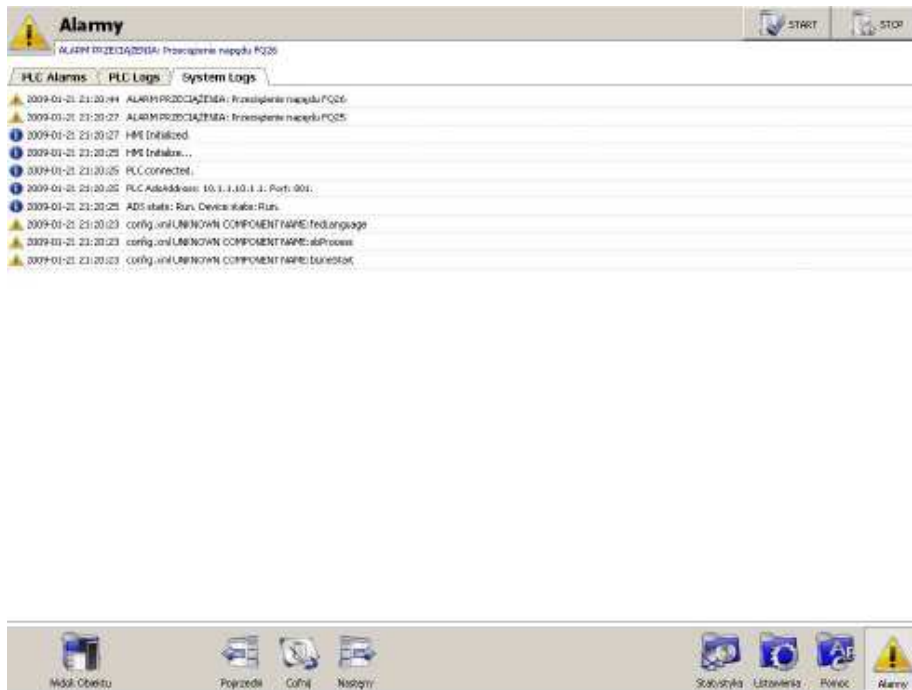
PLC reports of events

The list contains a history of any events which occurred in a PLC of an object. The events belong to one of three categories:

-  alarm- described above;
-  warnings- uncritical errors of a steering system;
-  information- announcements.

Steering panel reports of events

The list contains a history of events in a steering panel application in categories as was shown.



2. Steering process service

Before getting down to work with a driver, one should make sure that all elements of a system are efficient. A proper work of all sensors placed on an object is vital in particular. An adequacy of a sensor's work may be confirmed by the means of object view functions and a graphic presentation of their states.

2.1 Start- up of a process

To start a system's work one should turn on a feeding by a 'master connector' and delete ESR alarm's safeties by a 'reset/start' button, enlighten in a green colour, unless ESR module is switched on. A successful deleting of ESR modules' errors is signalized by a lights' vanishing.

Drives' start- up is carried out by pushing a START button, placed in an information heading of a panel's window or by repushing a 'reset/ start' button. A start of a system is preceded by a sound signal during which a start- up process may be interrupted by a STOP button.

2.2 Process stop

To stop a process one should push a STOP button, placed in a information heading of a panel window.

2.3 BYPASS mode

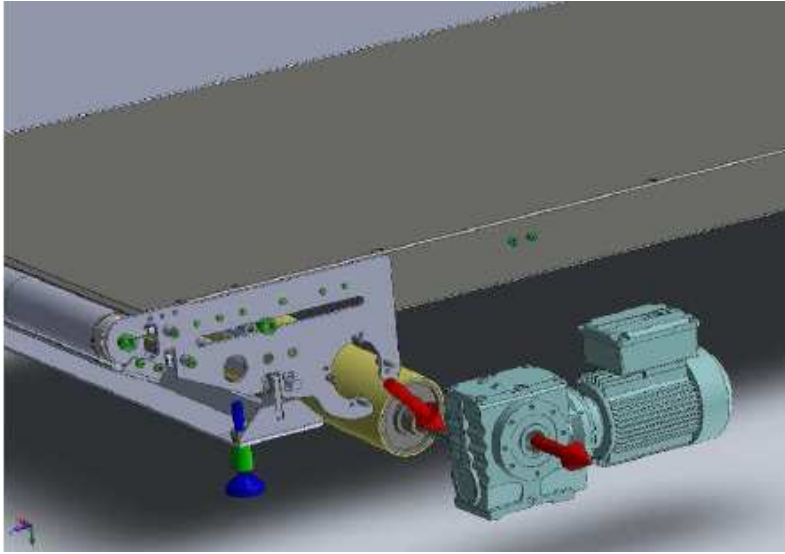
The mode was designed to work in case of a dysfunction of: a VIS scanning device or conveyors which are connected to it. Before a readoption of a transport line a driver's feeding should be turned off by a master connector. Mechanical operations should be effected according to a technical documentation. After a proper installation of a BYPASS conveyor, it is necessary to turn on its feeding by putting in a GND plug into a feeding socket of WD 32 motor. After a driver's start- up, it is automatically combined to work in a BYPASS mode.

3. Author's constructive solutions for baggage conveyors

3.1 Conveyors' construction, designed and performed by Dimark company is specific for its unique characteristics which shortens to a necessary minimum time, required to effect a technical service or to remove possible damages of exploitative components. The following systems were applied among others:

- Dimark Protecting System- a solution which protects a conveyed baggage, a conveyor's construction and a belt against damage due to elements hung to a baggage;
- a solution which makes the conveyors' usage simpler by a limitation to a necessary minimum operations connected with a possible exchange of exploitative components, such as shafts, rollers or belts.

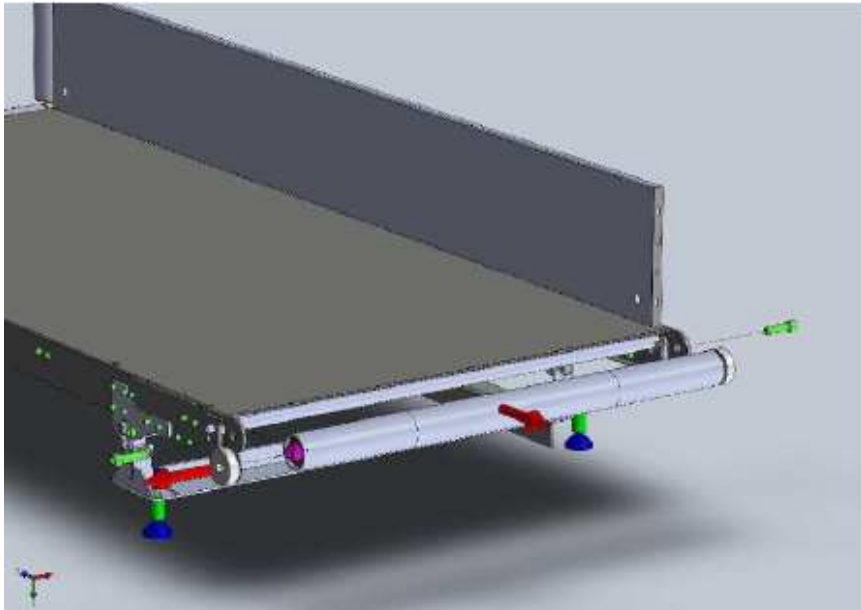
3.1.a Shaft exchange



A shaft exchange in a conveyor is limited to effecting several simply operations:

- loosening a conveying belt;
- motor dismantling;
- removing a trunnion from a conveyor's casing;
- moving out a shaft from a conveyor's case.

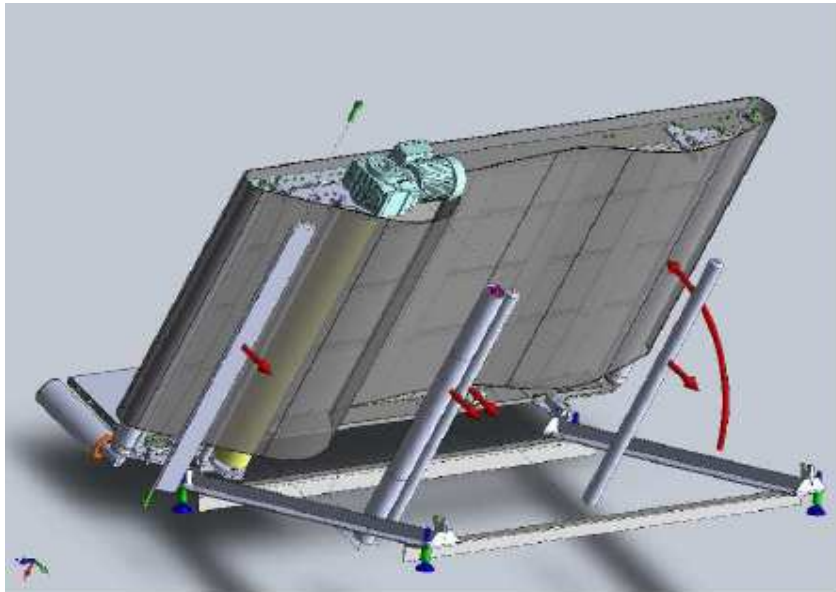
3.1.b Roller exchange



In order to remove a roller, the following operations are necessary:

- loosening a conveying belt;
- unscrewing clamping screws of a roller from a conveyor's construction;
- removing a roller.

3.1.c Belt dismantling



Operations which are to be carried out:

- dismantling of a retracting and supporting roller;
- deflecting upwards a conveyor's case;
- removing a belt.

The above presented solutions are conventionally applied by Dimark company in already performed and currently being performed projects for baggage handling systems at the airports:

- in Krakov- Balice, Poland;
- in Poznań Ławica, Poland;
- In Bydgoszcz, Poland;
- In Wrocław, Poland.