Qimarox®

Functional description software function block

Prorunner mk5

Printing date : 27/07/2018
Revision : Version 1.4
Author : B. Jansen

1 Version control

Tabel 01: Version control

Revision	Date	Author	Order number	Reason for revision
1.0	27-12-2017	BJA	Q17150	Initial preparation of description - Prorunner mk5
1.1	02-01-2018	BJA	Q17150	Modifications after feedback NNO
1.2	08-01-2018	BJA	Q17150	Modifications after consultation with CSE
1.3	27-01-2018	BJA	Q18150	Modifications after test Fancy Foods + adding Prorunner/Input/output steps
1.4	01-02-2018	BJA	Q18150	Translation from Dutch to English
1.5	26-7-2018	BJA	Q18150	Update because of new electrical drawing

2 Table of contents

3 Introduction

This document attempts to provide as clear as possible an insight into the functionality, operation and components of the Prorunner mk5 for designing and commissioning the software function blocks for the OEM / system integrator.
Commissioning must be possible using the Qimarox configuration sheet.

The Qimarox configuration sheet has an option to produce a PDF document containing all required settings (Example is showed below)

Prorunner mk5 *v4.0*
mk5 18XXXXX rev -

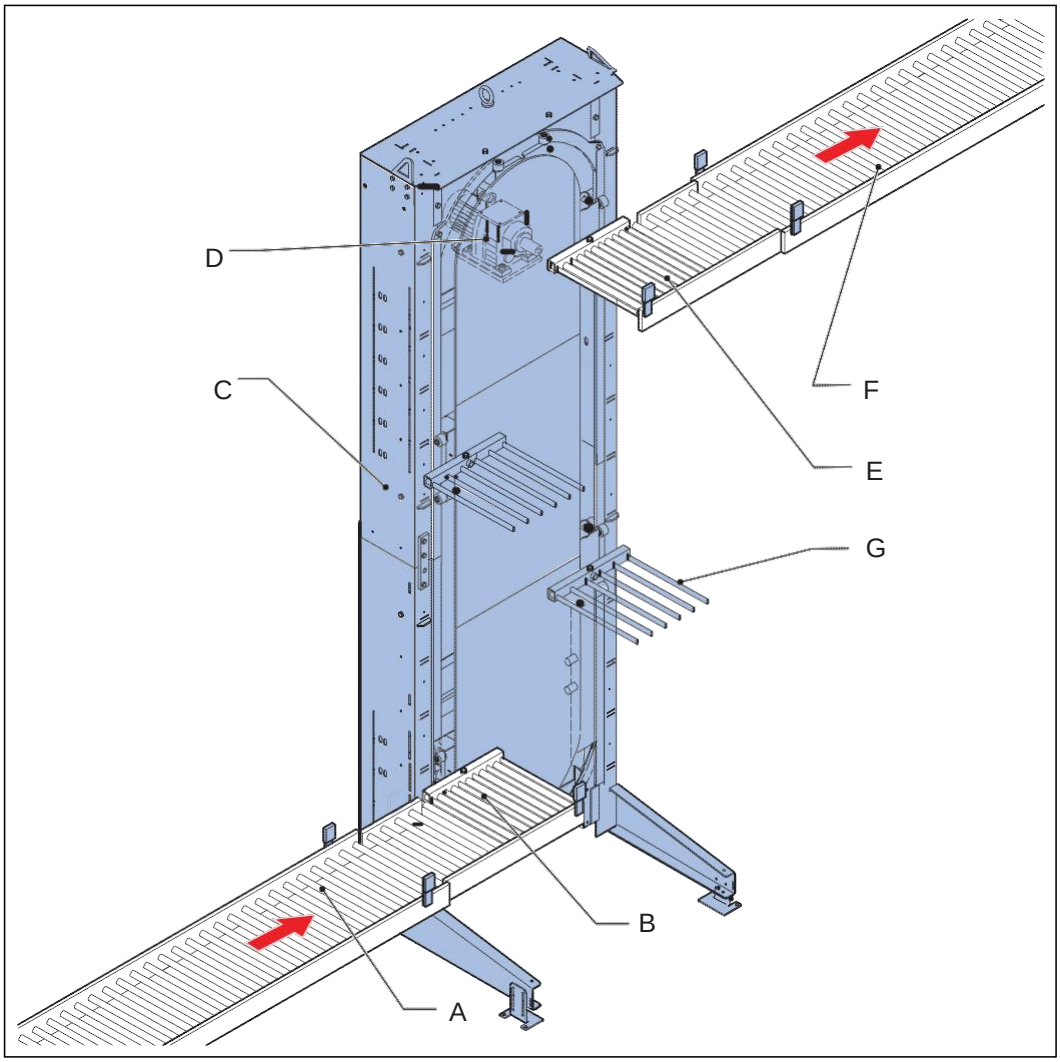
STANDARD SOFTWARE SETTINGS

Variable name	Value	Unit	Type
Prorunner.Speed	0,354	m/s	Real
Prorunner.DesignSpeed	419	1/h	Real
Prorunner.Carriers	3	-	Int
Options.RotationDetection	True	-	Bool
Options.FrontInfeedOutfeed	False	-	Bool
Chain.MinimumLength	3023	mm	Real
Chain.MaximumLength	3073	mm	Real
Chain.TotalLength	8966	mm	Real
ObjectDimension.MaxHeight	400	mm	Real
ObjectDimension.MaxLength	600	mm	Real
ObjectDimension.MinLength	225	mm	Real
ObjectDimension.MaxWidth	400	mm	Real
Automatic.Speed	50	Hz	Int
Automatic.Acceleration	1500	ms	Int
Automatic.Deceleration	500	ms	Int
Infeed.Speed	0,52	m/s	Real
Infeed.Length	750	mm	Int
Infeed.CycleTime	2,18	s	Real
Infeed.Automatic.Speed	50	Hz	Int
Infeed.Automatic.Acceleration	0,26	ms	Int
Infeed.Automatic.Deceleration	0,26	ms	Int
Outfeed.Speed	0,52	m/s	Real
Outfeed.Length	750	mm	Int
Outfeed.Automatic.Speed	50	Hz	Int
Outfeed.Automatic.Acceleration	0,26	ms	Int
Outfeed.Automatic.Deceleration	0,26	ms	Int

If you don't have this document, please contact Qimarox using the following email address Sales@qimarox.com; Please also mention the Qimarox serial number in the mail

4 Description Prorunner mk5

Figuur 01: Description Prorunner mk5



A. Third-party supply conveyor (not part of Prorunner mk5 control system)
B. Prorunner mk5 infeed conveyor (Example, depending on configuration) (Optional)
C. Prorunner mk5 Lift column
D. Motor for Prorunner lifting motion
E. Prorunner mk5 outfeed conveyor (Example, depending on configuration) (Optional)
F. Third-party outfeed conveyor (not part of Prorunner mk5 control system)
G. Product carriers

The Prorunner mk5 is used to bring products from a receiving level to a delivery level. The system offers options to transport products from a higher level to a lower level or vice versa. In this overview, you will see the option of moving products from a lower level to a higher level.
The principle is that the product lift runs continuously, and the products are fed in on the infeed conveyor and fed out on the outfeed conveyor in a controlled manner.

5 Configuration Prorunner mk5

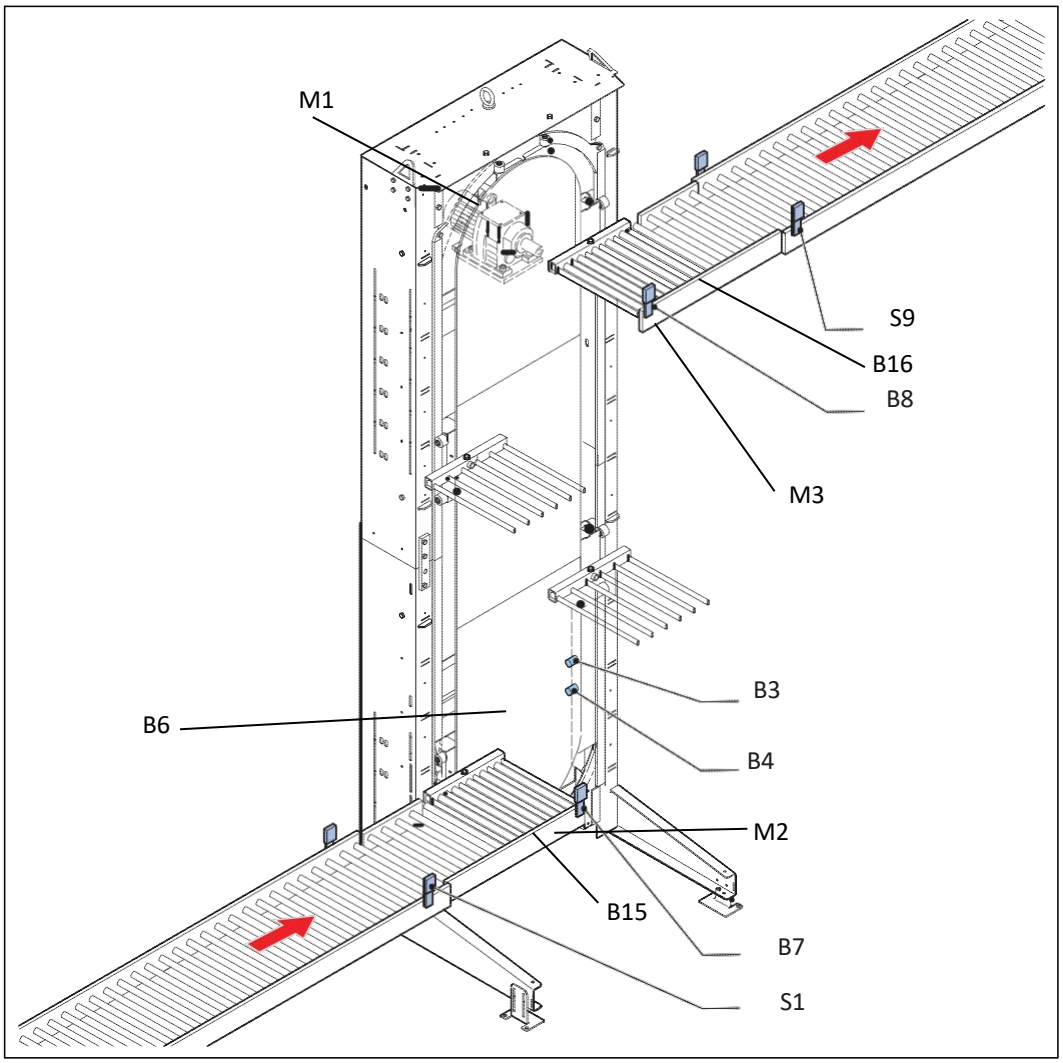
The configuration consists of one UDT. Everything is determined in the Qimarox configuration sheet.
UDT → 'UDT_Prorunner_mk5_Configuration'

Tabel 02: Configuration Prorunner mk5

Naming	Data type	Unit	Description
Prorunner.Speed	Real	m/s	Speed of the Prorunner at nominal speed (meter per second)
Prorunner.DesignSpeed	Real	p/h	Processing rate of products per hour
Prorunner.Carriers	Int	0..99	Number of carriers present on Prorunner mk5
Prorunner.Options.RotationDetection	Bool	0/1	Sensor used for rotation safeguard.
Prorunner.Options.FrontInfeedOutfeed	Bool	0/1	Sensors B7/B8 must be ignored for a longer period of time because both conveyors are located on the front side and the photocells are therefore triggered by the carriers. Time period is determined by pulses from rotation security.
Chain.MinimumLength	Int	mm	Minimum chain length between carriers
Chain.MaximumLength	Int	mm	Maximum chain length between carriers
Chain.TotalLength	Int	mm	Total chain length all carriers
ObjectDimension.MaxHeight	Int	mm	Maximum height of objects
ObjectDimension.MinLength	Int	mm	Minimum length of objects
ObjectDimension.MaxLength	Int	mm	Maximum length of objects
ObjectDimension.MaxWidth	Int	mm	Maximum width of objects
Prorunner.Automatic.Speed	Int	Hz	Setpoint speed (50 Hz = nominal)
Prorunner.Automatic.Acceleration	Int	ms	Number of milliseconds to accelerate from standstill to desired speed
Prorunner.Automatic.Deceleration	Int	ms	Number of milliseconds to decelerate from current speed to standstill
Infeed.Speed	Real	m/s	Speed of conveyor at nominal speed (meter per second)
Infeed.Length	Int	mm	Exact length of infeed conveyor
Infeed.CycleTime	Real	s	Exact needed transport time in seconds
Infeed.Automatic.Speed	Int	Hz	Setpoint speed (50 Hz = nominal)
Infeed. Automatic.Acceleration	Int	ms	Number of milliseconds to accelerate from standstill to desired speed
Infeed.Transport.Deceleration	Int	ms	Number of milliseconds to decelerate from current speed to standstill
Outfeed.Speed	Real	m/s	Speed of conveyor at nominal speed (meter per second)
Outfeed.Length	Int	mm	Exact length of outfeed conveyor
Outfeed.Automatic.Speed	Int	Hz	Setpoint speed (50 Hz = nominal)
Outfeed.Automatic.Acceleration	Int	ms	Number of milliseconds to accelerate from standstill to desired speed
Outfeed.Automatic.Deceleration	Int	ms	Number of milliseconds to decelerate from current speed to standstill

6 Operating principle Prorunner mk5

Figuur 02: Components overview Prorunner mk5



B3	Carrier allowing product infeed
B4	Carrier at position protection outfeed conveyor free
B6	Rotation detection on the sprocket (Optional)
B15	Sensor detection start of infeed roller conveyor (Contour monitoring)
B7	Sensor detection product present on infeed roller conveyor
B8	Sensor detection product present on outfeed roller conveyor
B16	Sensor detection product at end of outfeed roller conveyor
S1	Signal downstream products to Prorunner (not part of Prorunner mk5 control system)
S9	Signal upstream outfeed conveyor products empty (not part of Prorunner mk5 control system)
M1	Motor Prorunner
M2	Motor infeed conveyor (Optional)
M3	Motor outfeed conveyor (Optional)

6.1 Start-up Prorunner mk5

To be able to run the Prorunner, you must first check whether the Prorunner is empty.
This is checked by letting the infeed conveyor & outfeed conveyor run for a calculated time.
For the outfeed conveyor, not a single photocell should be covered.
For the infeed conveyor, either not a single photocell should be covered OR photocell B7 may be covered and photocell B15 may not!

This start-up procedure is performed in the following situations:

- First start after switching on
- After a fault
- After a standstill of at least 1 hour

The start-up time is determined by 3 factors (partially from configuration sheet)

1. Length of conveyor track (mm)
2. Speed of conveyor track (m/s)
3. Safety margin (200%)

$$Startup\ time\ = \frac{Length}{Speed\ \times\ Margin}$$

Example:
Length = 600mm, Speed = 0,5 ms.

$$\frac{600\ mm}{0.5\ mm/ms} \times 2.0 = 2400ms = 2.4s$$

6.2 Product infeed Prorunner mk5

The product is on the supply conveyor of third parties and is monitored by the program of the downstream installation.
By means of a communication signal (S1), the Prorunner knows that a product is ready for infeed.
The product waits at this position until the Prorunner gives a release signal for product infeed.

Conditions for starting product infeed:

- Prorunner in correct position B3
- Free Transport conveyor (B7 + B15 free)
- Motor of Prorunner running, company controller ready (B6 detects movement)
- Motor infeed conveyor running
- Third-party infeed conveyor gives signal that product is ready (S1)
- Command / infeed authorisation is present

If S1/B7/B15 are not covered for 1 min, the infeed conveyor will stop turning (empty signal). As soon as 1 of these sensors becomes covered, the infeed conveyor will start to rotate again.

Infeed may start if all these conditions are met. Infeed memory is started when sensor B15 is operated.
Product infeed memory is stopped when sensor B7 is covered and B15 is free.
Release signal to third-party supply conveyor falls away on the descending flank of S1

If infeed memory is high, 3 safeguards will start running:

1. Length check (B15)
2. Minimum infeed time
3. Maximum infeed time

6.2.1 Time window product infeed

Sensor B3 permits infeed to start; this signal may be extended by a period of time in order to be able to start a transport if there is still room between the carriers.
This will depend on:

1. Minimum distance between carriers
2. Speed of Prorunner (m/s)
3. Distance/Length of infeed (mm)
4. Speed of conveyor track (m/s)
5. Safety margin (90%)
6. Acceleration time infeed conveyor (ms.)

$Infeeding\ time\ = \frac{Minimum\ distance\ between\ carrier}{Speed\ Prorunner} - \frac{Length\ infeeding}{Speed\ infeeding} \times\ Margin$ - (Acceleration time / 2)

$$\frac{1500\ mm}{0.5\ mm/ms} - \frac{400\ mm}{0.3\ \frac{mm}{ms}} \times 0.9 - 250ms = 1250ms = 1.25s$$

6.2.2 Smallest product detection

The smallest product that may pass over the Prorunner is 225 mm. If photocell B15 is operated less than this time, an unknown product has been detected and the Prorunner must stop.

Smallest product detection time is determined by 3 factors:

1. Length of smallest product (minimum 225 mm)
2. Speed of conveyor track (m/s)
3. Safety margin (110%)

$$Minimum\ detection\ time\ photocell\ sensor\ = \frac{Length\ of\ smallest\ product}{Speed} \times\ Margin$$

$$\frac{225\ mm}{0.4\ mm/ms} \times\ 1.1 = 619ms = 0.69s$$

6.2.3 Length check

As soon as the object arrives in photocell B15, the length check is started; if the time is exceeded, infeed is stopped and the Prorunner must also stop.
This prevents multiple products from being fed in at the same time.
Length check is determined by 3 factors:

1. Length of longest product (mm)
2. Speed of conveyor track (m/s)
3. Safety margin (110%)

$$Length\ check\ = \frac{Length}{Speed} \times\ Margin$$

$$\frac{400\ mm}{0.4\ mm/ms} \times 1.1 = 1100ms = 1.1s$$

6.2.4 Minimum infeed time

Transport is normally completed if B7 is covered and B15 is free. If this happens in too short a time span, it is possible that an unknown object is present on the infeed conveyor.
So if B7 is covered and B15 becomes unoccupied within the minimum infeed time, infeed is stopped and the Prorunner must also stop.
Minimum infeed time is determined by 3 factors:

1. Length of infeed conveyor (mm)
2. Speed of conveyor track (m/s)
3. Safety margin (75%)

$$Minimum\ infeeding\ time\ = \frac{Length}{Speed} \times\ Margin$$

$$\frac{400\ mm}{0.5\ mm/ms} \times\ 0.75 = 600ms = 0.6s$$

6.2.5 Maximum infeed time

Transport is normally completed if B7 is covered and B15 is free. Should this happen in too long a time span, it is possible that the object is being obstructed somewhere.
So infeed must be stopped and the Prorunner must also stop.
Maximum infeed time is determined by 2 factors:

1. Calculated cycle time by Qimarox (s)
2. Safety margin (125%)

$$Maximum\ infeed\ time\ =\ \text{Cycle time}\ \times\ Margin$$

$$1.5s\ \times\ 1.25 = 1875ms = 1.875s$$

6.3 Movement of Prorunner mk5

Prorunner will always run. In the event of an empty signal, the Prorunner will remain in place but at the position at which infeed is possible (Sensor B3).
After sensor B7 is occupied on the infeed conveyor, the Prorunner will start up.
The empty signal time is determined by:

1. The total chain length (mm)
2. Speed of Prorunner (m/s)
3. Safety margin (125%)

$$Empty\ signal\ = \frac{Total\ chain\ length}{Speed\ prorunner} \times\ Margin$$

$$\frac{25000\ mm}{0.5\ mm/ms} \times 1.50 = 62.500ms = 62.5s$$

Prorunner movement conditions

- Sufficient product supply (No empty signal)
- Product infeed is completed within maximum time window.
- Rotation detection (B3) detect chain wheel rotation at desired speed (Optional)
- Infeed sensor (B3) detects each carrier
- Outfeed sensor (B4) detects each carrier
- Outfeed conveyor is empty (as soon as carrier enters hazardous area), sensor B7 & B15 see nothing

When Prorunner running, 2 safeguards are active:

1. Rotation safeguard through sensor B6 (If activated in configuration)
2. Carrier detection of sensor B3/B4

6.3.1 Rotation detection

The rotation detection protects the lift components against extensive damage in the event of movement blocking.
When the motor is running, a pulse must come in from the sensor B6 within a short period of time. If not, Prorunner must stop immediately.
Security is ignored during motor acceleration.
If the option is deactivated, the check will not be performed.

Rotation safeguard is determined by 3 factors:

1. Chain pitch (25.4 mm)
2. Speed of Prorunner (m/s)
3. Safety margin (150%)

$$Maximum\ time\ = \frac{Chain\ pitch}{Speed} \times\ Margin$$

$$\frac{25.4\ mm}{0.5\ mm/ms} \times 1.50 = 76.2ms = 0.076s$$

6.3.2 Carrier detection

The infeed sensor (B3) and outfeed sensor (B4) must detect each carrier because of their important function. The system calculates from the distance between the carriers how long the maximum time may be between each carrier. If the time limits are exceeded, the Prorunner must stop immediately.

Carrier detection time is determined by 3 factors:

1. Maximum length between carriers (mm)
2. Speed of Prorunner (m/s)
3. Safety margin (125%)

$$Maximum\ time\ = \frac{Maximum\ length\ between\ carriers}{Speed} \times Margin$$

$$\frac{1500\ mm}{0.5\ mm/ms} \times 1.25 = 3750ms = 3.75s$$

6.3.3 Manual operation Prorunner

The Prorunner may be moved forward and backward by hand.

During manual operation, rotation safeguard is active (if activated).

When moving forward, the sensors B8 and B16 must not be occupied.
The sensors B7 and B15 must not be occupied while moving backwards.

During manual operation, a fixed speed is active. This will be 20Hz with an acceleration of 0.5s and a deceleration of 0.25s

6.4 Product outfeed Prorunner mk5

Product outfeed conditions:

- Outfeed conveyor track M3 occupied, sensor B8 occupied
- Upstream conveyor track gives signal (S9) indicating it is able to receive product.

If upstream conveyor track does not give signal (S9), outfeed conveyor track will stop. As soon as the following carrier is observed by sensor B4.

During product outfeed, three security devices are active:

1. Outfeed conveyor busy
2. Maximum outfeed time
3. Smallest product detection (B16)

6.4.1 Outfeed conveyor busy

If one of the product lift supports enters the hazardous area, and this is detected by sensor B4, there will be checked whether the outfeed conveyor is free. The control area is lengthened by means of time duration; the length of this is determined by:
Carrier detection time is determined by 3 factors:

1. Highest object height (mm)
2. Speed of Prorunner (m/s)
3. Safety margin (80%)

$$Time\ extension\ = \frac{Object\ height}{Speed} \times Margin$$

$$\frac{400\ mm}{0.5\ mm/ms} \times 0.8 = 640ms = 0.64s$$

Sensors B8 & B16 must be both unoccupied and the outfeed procedure must be completed, otherwise Prorunner will stop turning.

The Prorunner checks whether the outfeed procedure is carried out properly.
Procedure starts as soon as sensor B8 becomes occupied and is only completed when sensor B16 becomes unoccupied.
This order must always be followed.
If B16 becomes occupied when B8 is not first occupied, the Prorunner & outfeed conveyor must stop immediately.

6.4.2 Maximum time limit outfeed conveyor

During product outfeed it is monitored whether outfeed is completed within maximum time limits; if this time is exceeded a fault will occur. Prorunner & outfeed conveyor must stop immediately.

Maximum outfeed time is determined by 3 factors:

1. Length of outfeed conveyor (mm)
2. Speed of conveyor track (m/s)
3. Safety margin (125%)

$$Length\ check\ = \frac{Length}{Speed} \times\ Margin$$

Example:
Length = 400mm, Speed = 0.5 m/s

$$\frac{600\ mm}{0.5\ mm/ms} \times\ 1.25 = 1500ms = 1.5s$$

6.4.3 Smallest product detection

The smallest product that may pass over the Prorunner is 225 mm. If photocell B15 is operated less than this time, an unknown product has been detected and the Prorunner must stop.

Smallest product detection time is determined by 3 factors:

4. Length of smallest product (225 mm)
5. Speed of conveyor track (m/s)
6. Safety margin (110%)

$$Minimum\ detection\ time\ photocell\ = \frac{225}{Speed} \times\ Margin$$

$$\frac{225\ mm}{0.4\ mm/ms} \times\ 1.1 = 619ms = 0.69s$$

6.5 Status Prorunner mk5

The status of the PRORUNNER is brought out, giving the user a clear picture of the status / movements of the Prorunner mk5

Tabel 03: Status Prorunner mk5

Code	Description / Cause
0	NO ACTION: Prorunner switched off / no mode active
1	MANUAL OPERATION: Prorunner in manual mode
2	MANUAL OPERATION BLOCKED: Prorunner blocked in manual mode
3	CONFIGURATION CHECK: Prorunner configuration is checked
4	Start-up PROCEDURE BUSY Prorunner busy with start-up procedure.
7	BLOCKED: Prorunner blocked in automatic mode
10	RUNNING: Prorunner movement and ready
11	INFEED + OUTFEED OF OBJECT BUSY: Prorunner infeed + outfeed conveyor track busy with infeed + outfeed of object.
12	OBJECT INFEEDING BUSY: Prorunner infeed conveyor busy with object infeed.
13	OBJECT OUTFEEDING BUSY: Prorunner outfeed conveyor track busy feeding out object.
20	EMPTY SIGNAL >> GO TO WAITING POSITION: Prorunner enters infeed mode.
21	EMPTY SIGNAL >> WAIT FOR NEW OBJECT: Prorunner waits at the infeed level until supply track indicates that an object is ready.
22	EMPTY SIGNAL >> START UP: Prorunner will restart after new object is ready on the infeed conveyor

6.6 Faults Prorunner mk5

In case of a fault, the software function block issues an outfeed signal and a fault word (16 bits).
Each bit of the word has its own unique fault.
Below is the list of faults that can be active with explanation/effect and solution.
Certain faults are only possible after selecting/activating certain options.

Malfunctions will block or stop automatic operation in all cases. If all reset conditions are met and the user gives the reset command, the fault will disappear.
The latter does not apply to faults that can solve themselves.

Tabel 04: Prorunner mk5 fault list

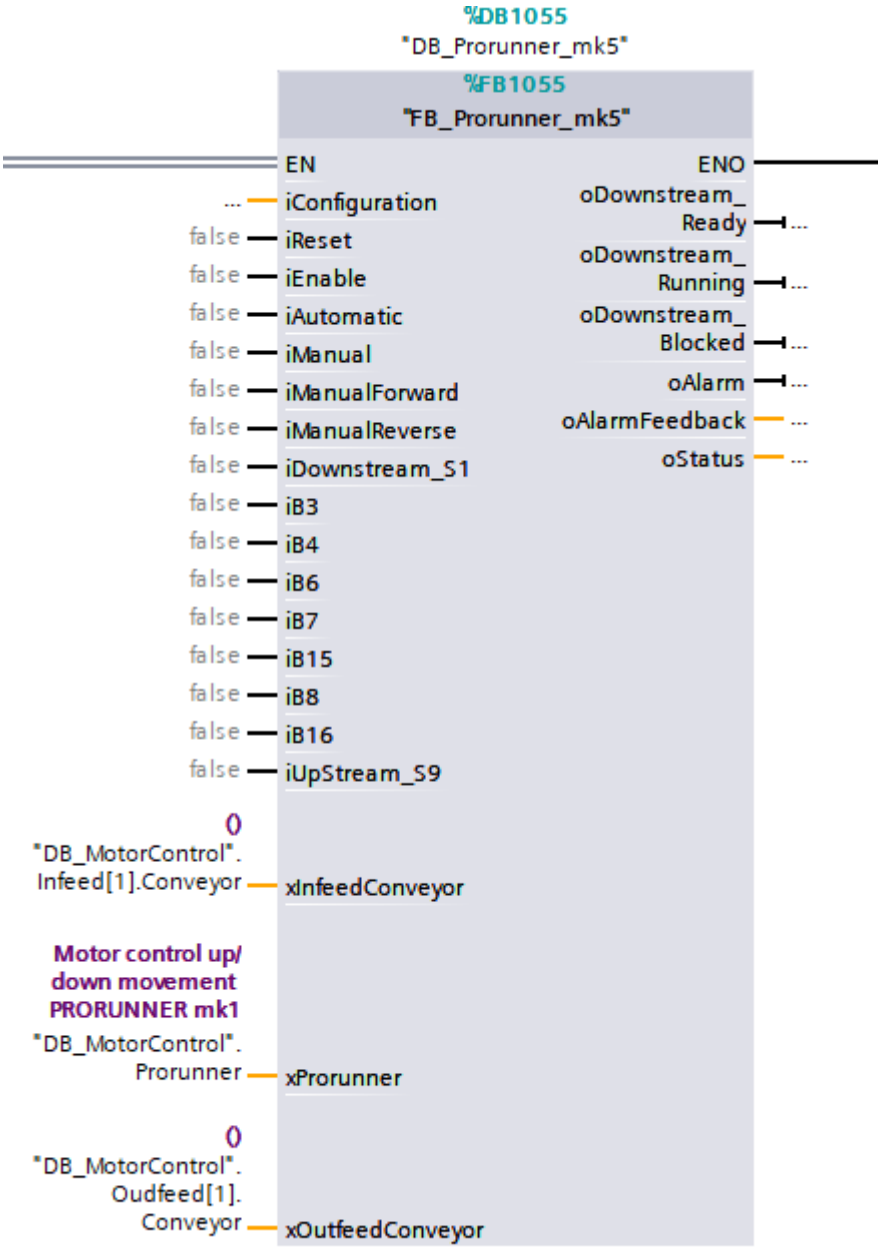
Bit	Description / Cause	Effect	Solution
0	Configuration not completed correctly (Completion safeguard)	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Check all configuration times. No setting (except for Rotation safeguard) may be set to '0' or smaller than the minimum allowed. Give the reset command to reset the fault.
1	Movement of Prorunner blocked. Rotation detection(B6) no longer detect movement.	Automatic operation is stopped. Prorunner mk5 is quickly stopped (Quickstop)	Check Prorunner for blockages; if no obstructions are detected, check operation/adjustment of sensors. Give the reset command to reset the fault.
2	Sensor B3 for infeed security not seen by carrier within time limits	Automatic operation is stopped. Prorunner mk5 is quickly stopped (Quickstop)	Check adjustment sensor B3 Prorunner. Give the reset command to reset the fault.
3	Sensor B4 for outfeed security not seen by carrier within time limits	Automatic operation is stopped. Prorunner mk5 is quickly stopped (Quickstop)	Check adjustment sensor B4 Prorunner. Give the reset command to reset the fault.
4	An unknown object was detected on the infeed conveyor by sensor B15. The infeed conveyor sees that B15 was activated at an unexpected/incorrect moment.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on the infeed conveyor. Give the reset command to reset the fault. Reset command is accepted if B7 is occupied and B15 is unoccupied, or if B7 + B15 are both unoccupied.
5	An unknown object was detected on the infeed conveyor by sensor B7 The infeed conveyor sees that B7 was activated at an unexpected/incorrect moment.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on the infeed conveyor. Give the reset command to reset the fault. Reset command is accepted if B7 is occupied and B15 is unoccupied, or if B7 + B15 are both unoccupied.

Bit	Description / Cause	Effect	Solution
6	Length check infeed conveyor. Sensor B15 is not occupied long enough.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on the infeed conveyor. Give the reset command to reset the fault. Reset command is accepted if B7 is occupied and B15 is unoccupied, or if B7 + B15 are both unoccupied.
7	Length check infeed conveyor. Sensor B15 is occupied too long.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on the infeed conveyor. Give the reset command to reset the fault. Reset command is accepted if B7 is occupied and B15 is unoccupied, or if B7 + B15 are both unoccupied.
8	Infeed of object takes too little time. Unknown object identified at end of infeed conveyor.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on infeed conveyor. Give the reset command to reset the fault. Reset command is accepted if B7 is occupied and B15 is unoccupied, or if B7 + B15 are both unoccupied.
9	Infeed of object takes too long. Object seems to be blocked during transport	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on infeed conveyor. Give the reset command to reset the fault. Reset command is accepted if B7 is occupied and B15 is unoccupied, or if B7 + B15 are both unoccupied.
10	An unknown object was detected on the outfeed conveyor by sensor B16. The outfeed conveyor sees that B16 was activated at an unexpected/incorrect moment.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on the infeed conveyor. Give the reset command to reset the fault. Reset command is accepted when both B8 & B16 are free/unblocked
11	Length check outfeed conveyor. Sensor B8 is not occupied long enough.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Remove objects or move them to the correct position on the infeed conveyor. Give the reset command to reset the fault. Reset command is accepted when both B8 & B16 are free/unblocked
12	Length check outfeed conveyor. Sensor B16 is occupied too long.	Automatic operation is not possible.	Remove objects or move them to the correct position on the infeed conveyor.

Bit	Description / Cause	Effect	Solution
		Prorunner mk5 is quickly stopped (Quickstop)	Give the reset command to reset the fault. Reset command is accepted when both B8 & B16 are free/unblocked
13	Product outfeed taking too long. Sensor B8 or B16 is activated for too long.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Put product in the correct position manually. Give the reset command to reset the fault. Reset command is accepted when both B8 & B16 are free/unblocked
14	Outfeed conveyor is still occupied while carrier enters dangerous area. Sensor B8 or B16 still occupied when carrier is detected by sensor B4. This fault only becomes active when signal S9 is high.	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Fault disappears if sensors B8 or B16 remain unoccupied
15	Startup procedure; Product is still detected on the outfeed conveyor track	Automatic operation is not possible. Prorunner mk5 is quickly stopped (Quickstop)	Empty transport conveyors (sensor B7/B15/B8/B16 unoccupied). Restart procedure by giving reset command.

7 Software block Prorunner mk5

Figuur 03: Function block Prorunner mk5



7.1 Function block specifications

Block Name:	FB_Prorunner_mk5
Block Number:	FB1055
Version:	v4.0
Languages:	EN-US (English, United states)
Required PLC Blocks:	TON_TIMER
	FB_Delay (FB1059)
Required PLC data types:	UDT_MotorControl
	UDT_MotorControl_In
	UDT_MotorControl_Out
	UDT_Prorunner_mk5 _Configuration
Function Block Call	Cyclic (OB1)
Optimized block access	Yes/~~No~~
Programming language	LAD, SCL
STEP7 version	TIA Portal V14 + SP1

7.2 Inputs Prorunner mk5

Inputs are required for the system to function properly. Here the required sensors are declared, and the status of the installation.

Tabel 05: Inputs Prorunner mk5

Naming	Data type	Unit	Description
iConfiguration	UDT		**UDT_Prorunner_mk5_Configuration** This contains all requirements/settings for the installation to function properly. *Use the Qimarox configuration PDF document to fill in all the right configurations settings*
iReset	Bool	0/1	Reset command to reset faults / motors.
iEnable	Bool	0/1	System is switched on. Safety functions are operational power supplies to any controllers are switched on. 1 = Installation switched on
iAutomatic	Bool	0/1	Installation is in automatic mode. The direction of rotation of the Prorunner is only in the primary direction.
iManual	Bool	0/1	Installation is in manual mode. Manual commands influence the direction of rotation.
iManualForward	Bool	0/1	Command for upward movement (seen from input modules) in manual mode
iManualReverse	Bool	0/1	Command for downward movement (seen from input modules) in manual mode
iDownstream_S1	Bool	0/1	Sensor/signal from downstream system that an object is ready for infeed
iB3	Bool	0/1	Infeed security; Sensor position of carriers ready for infeed
iB4	Bool	0/1	Outfeed security; Sensor at position of carriers in hazardous area outfeed conveyor
iB6	Bool	0/1	Sensor at bottom sprocket for rotation detection
iB7	Bool	0/1	Sensor in middle of infeed conveyor (stop position of object)
iB15	Bool	0/1	Sensor at beginning of infeed conveyor (product position monitoring)
iB8	Bool	0/1	Product sensor on outfeed conveyor
iB16	Bool	0/1	Sensor product at the end of outfeed conveyor (product away from outfeed conveyor)
iUpstream_S9	Bool	0/1	Sensor/Signal from upstream system that system is ready to receive object (outfeed track is not full)

7.3 Outputs Prorunner mk5

Outputs must be declared by the integrator.
Outputs provide feedback such as faults, status and communication.

Tabel 06: Outputs Prorunner mk5

Naming	Data type	Unit	Description
oDownstream_Ready	Bool	0/1	Signal to downstream system that product infeed is allowed.
oDownstream_Running	Bool	0/1	Signal to downstream system that infeed conveyor motor is running
oDownstream_Blocked	Bool	0/1	Signal to downstream system that infeed is blocked, and infeed must be stopped !!
oAlarm	Bool	0/1	Fault active
oAlarmFeedback	Word	0	Current fault feedback (See chapter 'Faults' for the correct overview)
oStatus	Int	0	See chapter 'Status Prorunner mk5' for further information

7.4 In/Outputs Prorunner mk5

In/Outputs must be declared by the integrator.

Tabel 07: In/Outputs Prorunner mk5

Naming	Data type	Unit	Description
xInfeedConveyor	UDT		**UDT_MotorControl** Incoming/Outgoing command to the motor control of the infeed conveyor
xProrunner	UDT		**UDT_MotorControl** Incoming/Outgoing command to the motor control of the Prorunner
xOutfeedConveyor	UDT		**UDT_MotorControl** Incoming/Outgoing command to the motor control of the outfeed conveyor

7.5 Motor interface Prorunner mk5

All commands are prepared through the motor interface to handle different motor controls.
The motor interface handles the communication with the motor used to control the respective function.
The motor is controlled by means of commands and settings. The motor provides necessary feedback to maintain interaction

Tabel 08: Motor control interface incoming commands → **UDT_Motorcontrol_Status**

Naming	Data type	Unit	Description
Status.AtTargetSpeed	Bool	0/1	Motor is running at desired speed
Status.MotorIsRunning	Bool	0/1	Motor is running. In the case of a controller, this is used to check whether the output stage is actually running.
Status.Blocked	Bool	0/1	Motor/Drive blocked
Status.Pulse	Bool	0/1	Motor/Drive has moved itself 1cm (10mm)
Status.ActualSpeed	Real	m/s.	Speed in meter per second on which the Prorunner is rotating
Status.ActualFrequency	Real	Hz	Number of Hertz (frequency) what the motor is currently running at.

Tabel 09: Motor control interface outgoing commands → **UDT_Motorcontrol_Command**

Naming	Data type	Unit	Description
Command.Enable	Bool	0/1	Switch on motor control
Command.Reset	Bool	0/1	Reset motor control faults
Command.QuickStop	Bool	0/1	Stop motor quickly due to faults. (0.1 sec deceleration)
Command.Energize	Bool	0/1	Pre-magnetise motor
Command.Forward	Bool	0/1	Run motor forward, or send up
Command.Reverse	Bool	0/1	Run motor backwards, or send down
Command.HighSpeed	Bool	0/1	Use high speed (if this is fixed in the motor itself)
Command.Settings.Speed	Int	Hz	Number of Hertz of rated speed (Rated = 50 Hz)
Command.Settings.Acceleration	Int	ms	Number of milliseconds to accelerate from standstill to desired speed
Command.Settings.Deceleration	Int	ms	Number of milliseconds to decelerate from current speed to standstill

We recommend carrying out the motor with a frequency controller because there are different requirements for control:

- Mechanism is less loaded if engine starts slower by means of acceleration
- Quickstop must be possible

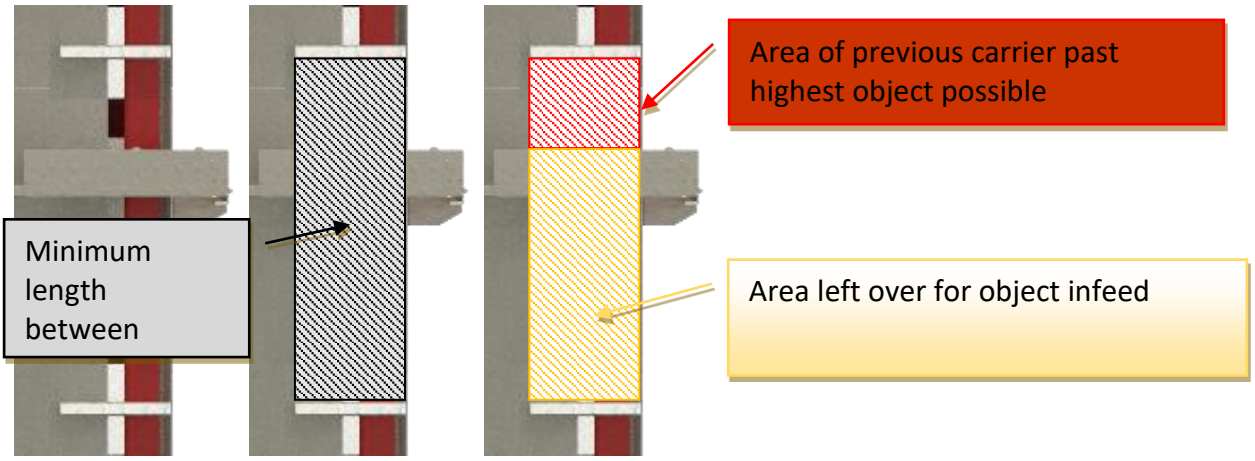
Quickstop = quickest possible stop with pre-defined deceleration in controller
This should be set to less than or equal to 0.1 second.

8 Sensor adjustment Prorunner mk5

8.1 Adjustment of sensor B3 (product infeed safeguard)

Sensor should be adjusted to the position of the highest product possible. After that, new objects can be fed in again. The sensor can be adjusted on any carrier.

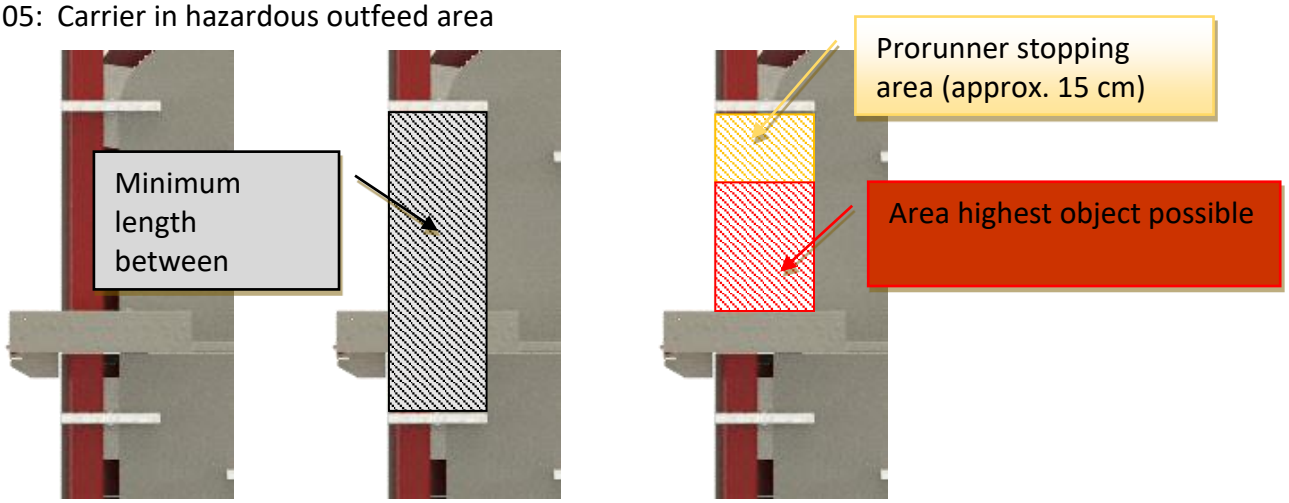
Figuur 04: Carrier in area ready (new) input



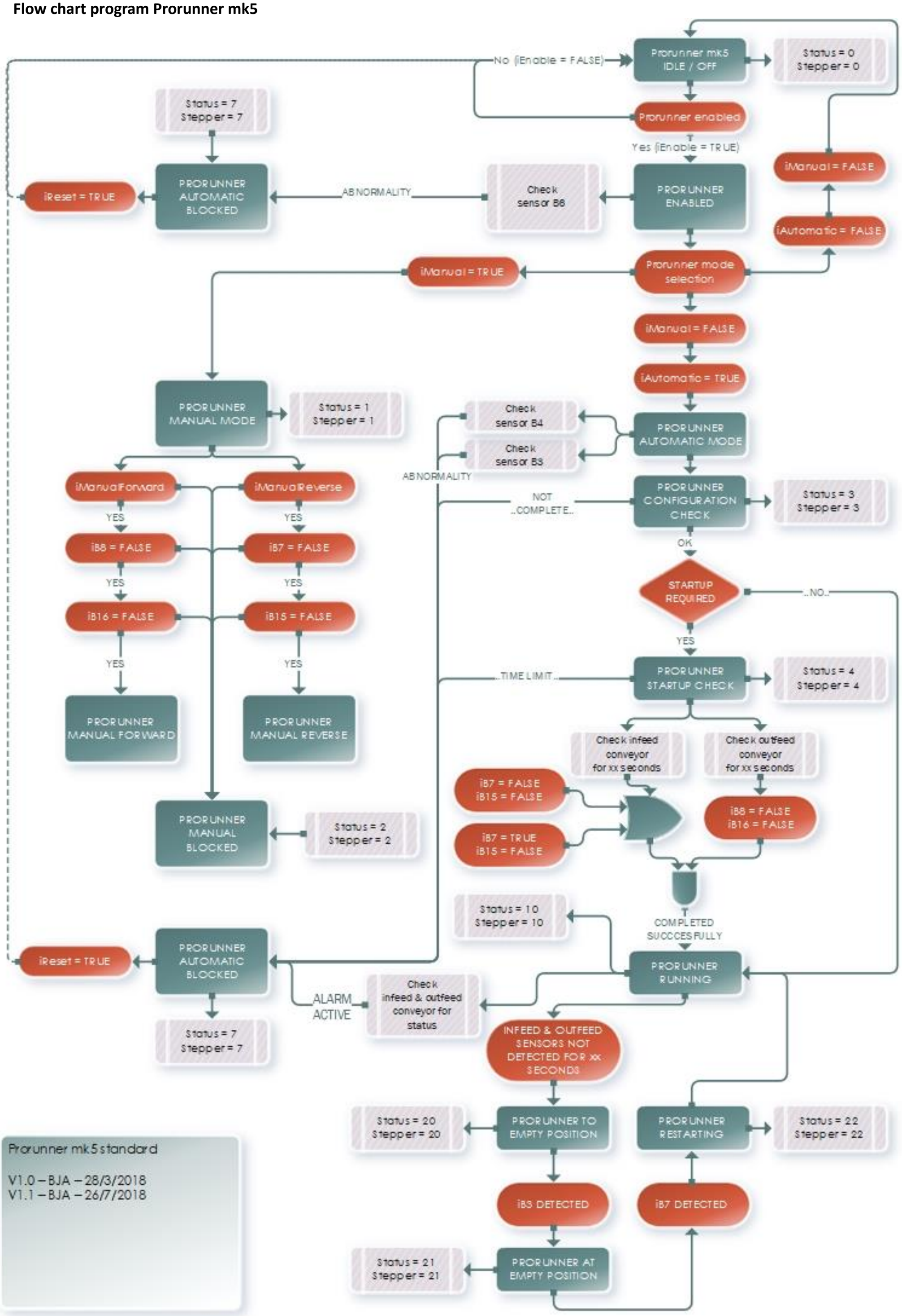
8.2 Adjusting sensor B4 (product outfeed safeguard)

Sensor must be adjusted to the position of the highest product possible + area to stop the Prorunner.
The sensor can be adjusted on any carrier.

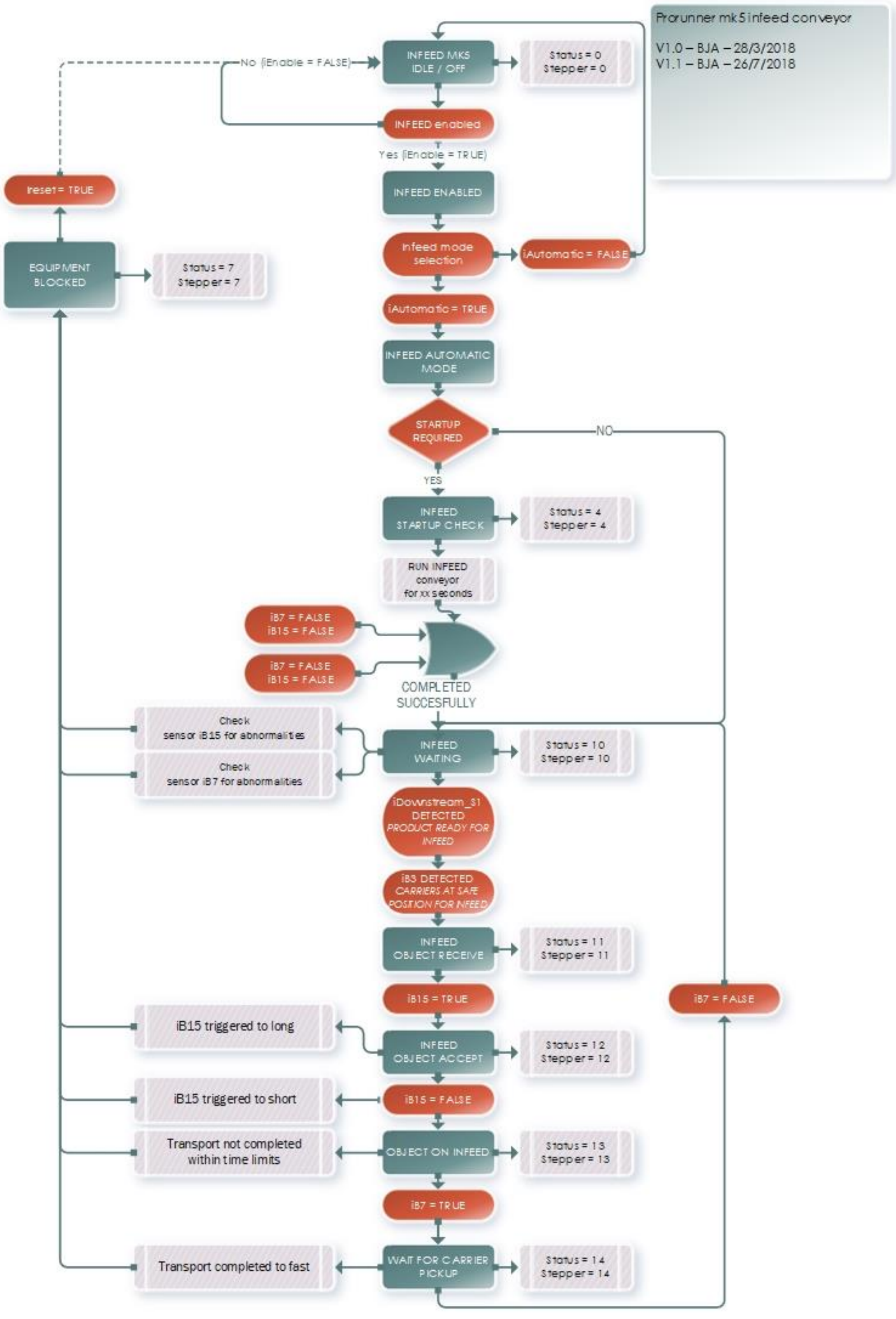
Figuur 05: Carrier in hazardous outfeed area



9 Flow chart program Prorunner mk5



10 Flow chart program infeed conveyor



11 Flow chart program outfeed conveyor