Dynamic Weather Assist

Safety System

SICK
Sensor Intelligence.

Described product

Dynamic Weather Assist

Manufacturer

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Legal information

Original document

This document is an original document of SICK AG.

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Contents

CONTENTS

1 About this document

1.1 Purpose of this document

These operating instructions contain the information needed for the implementation of the function block. This document describes:

- Individual components, if they are relevant to the function of the function block.
- The project planning
- The configuration
- The necessary thorough checks
- The commissioning
- The maintenance
- The troubleshooting

1.2 Scope

These operating instructions contain information regarding the Dynamic Weather Assist function block.

> **!** **NOTICE**
> The operating instructions of the components also apply.
>
> The relevant information must be made available to the employees for all work performed on the AGV system.

The following documents contain additional information:

Table 1: Available documents

Document type	Title	Part number
Operating instructions	outdoorScan3 – EtherNet/IP™	8023153
Operating instructions	Flexi Soft modular safety controller hardware	8012999
Operating instructions	Flexi Soft gateway hardware	8012662
Operating instructions	Flexi Soft in the Safety Designer	8013926
Operating instructions	Flexi Soft gateways in Flexi Soft Designer software	8018170

This document is included with the following SICK part numbers (this document in all available language versions):

8025646

1.3 Target groups of these operating instructions

Some chapters of these operating instructions are intended for certain target groups. However, the entire operating instructions are relevant for intended use of the product.

Table 2: Target groups and selected chapters of these operating instructions

Target group	Chapters of these operating instructions
Project developers (planners, developers, designers)	"Project planning", page 10 "Configuration", page 16
Installers	"Mounting", page 14
Electricians	"Electrical installation", page 15

Target group	Chapters of these operating instructions
Safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application)	"Project planning", page 10 "Configuration", page 16 "Commissioning", page 17
Operators	"Operation", page 18 "Troubleshooting", page 20
Maintenance personnel	"Maintenance", page 19 "Troubleshooting", page 20

1.4 Symbols and document conventions

Warnings and other notes

⚠ **DANGER**
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

⚠ **WARNING**
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

⚠ **CAUTION**
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

[!] **NOTICE**
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

ⓘ **NOTE**
Highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

Instructions to action

► The arrow denotes instructions to action.

1. The sequence of instructions for action is numbered.
2. Follow the order in which the numbered instructions are given.
✓ The check mark denotes the result of an instruction.

1.5 Further information

www.sick.com

The following information is available via the Internet:

- This document in other languages
- Operating instructions and mounting instructions of SICK components suitable for the function block
- The Safety Designer configuration software
- Guide for Safe Machinery ("Six steps to a safe machine")

2 Safety information

2.1 Intended use

The function block is used in AGVs exposed to weather conditions in outdoor areas. If precipitation is heavy, the function block commands a reduction in AGV speed before the precipitation initiates an AGV stop. This can reduce AGV downtime.

Incorrect use, improper modification or manipulation of the function block will invalidate any warranty from SICK; in addition, any responsibility and liability of SICK for damage and secondary damage caused by this is excluded.

2.2 Improper use

The Dynamic Weather Assist function block does not fulfill any safety functions. You have to implement the safety functions, such as the AGV stopping function, on your own.

2.3 Requirements for the qualification of personnel

The product must be configured, installed, connected, commissioned, and serviced by qualified safety personnel only.

Project planning

You need safety expertise to implement safety functions and select suitable products for that purpose. You need expert knowledge of the applicable standards and regulations.

Mounting, electrical installation and commissioning

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

Operation and maintenance

You need suitable expertise and experience. You must be instructed in machine operation by the machine operator. For maintenance, you must be able to assess if the machine is operating safely.

3 Product description

3.1 Functionality

A safety laser scanner monitors the areas in the direction of travel of the AGV with 2 monitoring fields. The monitoring fields are sensitive and therefore get infringed by precipitation and other weather conditions before the AGV protective fields do.

The Dynamic Weather Assist function block evaluates the monitoring field signals. When the visibility worsens, a command is sent to the AGV control to reduce the speed.

When the AGV has reduced the speed, a smaller protective field can be used with field switching. The multiple sampling can also be increased if necessary. Since smaller protective fields are less affected by weather conditions, the AGV availability is increased.

3.2 Design of the overall system

Design of the overall system

The overall system comprises a total of three components:

- 1 or 2 outdoorScan3 Pro – EtherNet/IP™ safety laser scanners
- Flexi Soft safety controller
- AGV control
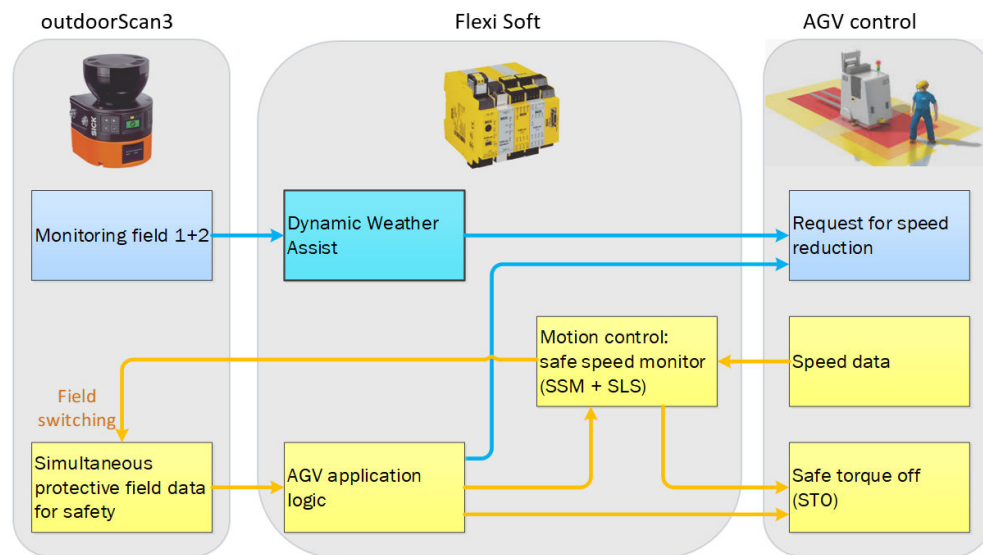
Figure 1: Complete system

The complete system implements safe and non-safe functions. The Dynamic Weather Assist function block enables a non-safe function. The safety functions for the AGV, such as the safety stop, safe monitoring of the speed or field switching, must be implemented independently by the integrator.

Further topics

- see "Information for safety assessment", page 10
- see "Interfaces", page 10

3.3 Requirements on the application

- The AGV does not need a protective field > 4 m.

3.4 Product characteristics

3.4.1 Command to reduce speed

Function

The monitoring fields of the safety laser scanner are briefly violated by precipitation such as rain or snow. The function block evaluates violations of the monitoring fields and commands a speed reduction if needed. The speed commanded depends on the intensity of the precipitation. If the precipitation is reduced, the speed can also be increased.

Significance of 2 monitoring fields

Monitoring field 1 is longer than monitoring field 2. When cornering, monitoring field 1 is typically violated by objects located in the curve next to the AGV lane. Monitoring field 2 is not violated by these objects. The function block considers the different violations of the two monitoring fields and does not request a speed reduction in this case.
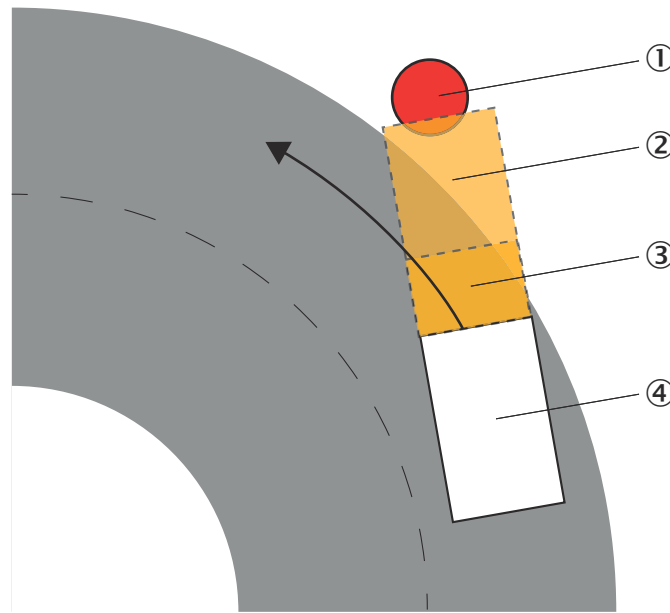
① Object next to the lane
② Monitoring field 1 is violated by object.
③ Monitoring field 2 is free.
④ AGV

4 Project planning

4.1 Manufacturer of the overall system

The Dynamic Weather Assist function block does not fulfill any safety functions. If correctly integrated into the logic, the function block does not pose a safety-relevant risk.

However, the manufacturer still has the following obligations relating to the complete AGV system:

▶ Executing a risk assessment.
▶ Verifying and validating the safety functions.
▶ Integrating the individual components in accordance with the appropriate standards.
▶ Please note that C standards have priority compared to statements from this documentation.

4.2 Integration into the logic configuration

4.2.1 Information for safety assessment

Important information

⚠ **WARNING**
Use of the function block in safety-relevant logic

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

▶ Use different logic pages for safe and non-safe logic.
▶ Only use the function block on logic pages with non-safe logic.
▶ Do not use the function block outputs for safety functions, e.g. switching of the monitoring case.
▶ Observe specifications of ISO 13849-1 for combining safe and non-safe logic.

Effects of possible errors

If correctly integrated into the logic, do you not have to consider the function block in the safety assessment. A possible function block error can only have the following effects:

• The function block commands a speed reduction although the weather conditions are good. The AGV moves slower.
• The function block does not command a speed reduction although the weather conditions are poor. The AGV still uses a large and sensitive protective field for stopping. The precipitation does not trigger an AGV stop.

In both cases, these are availability problems.

4.2.2 Interfaces

Important information

ⓘ **NOTE**
Evaluation of the function block outputs does not require safety capable inputs in the AVGs control. The signal can be transmitted through non-safe digital inputs or Ethernet.

Interfaces and signals

Table 3: Interfaces of the Dynamic Weather Assist function block

Designation	Type	Description
Monitoring field 1	Input	Signal connection monitoring field 1
Monitoring field 2	Input	Signal connection monitoring field 2
Level 1	Output	The signal levels of both outputs together cre-
Level 2	Output	ate the signal for the speed command for the AGV control.

Table 4: Signal for AGV speed

Weather conditions	Output level 1	Output level 2	AGV speed
No influence	Low	Low	Fast
Minimal precipitation	High	Low	Average
High precipitation	High	High	Slow

4.2.3 Additional logic for 1-of-n coding

If the AGV control expects a signal in the form of 1-of-n coding, you can implement this as in the following example.
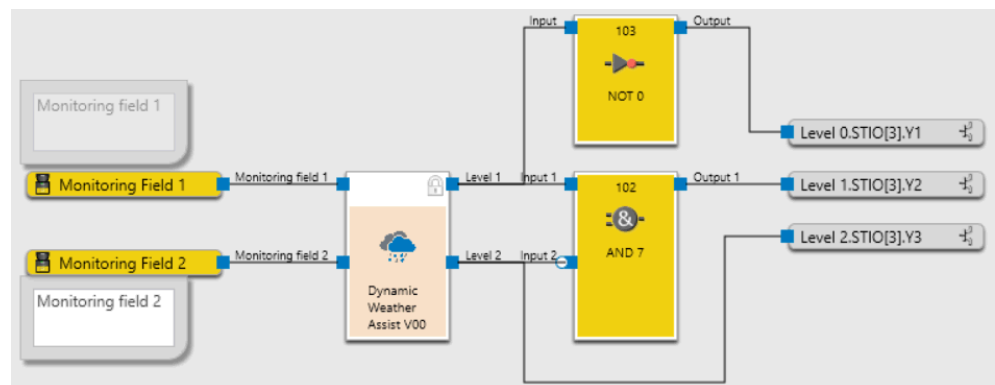
Figure 2: Example for additional logic for 1-of-n coding

This leads to the following behavior:

Table 5: Signal for AGV speed

Weather conditions	Function block outputs		AGV control outputs			AGV speed
	Level 1	Level 2	Level 0	Level 1	Level 2	
No influence	Low	Low	High	Low	Low	Fast
Minimal precipitation	High	Low	Low	High	Low	Average
High precipitation	High	High	Low	Low	High	Slow

4.2.4 Function block muting

If you have to implement function block muting, you can do this as shown in the following example.
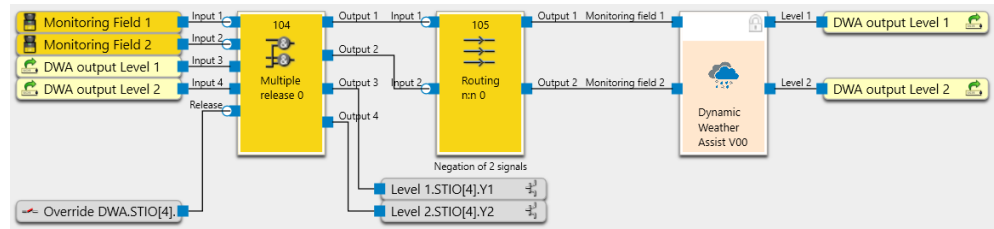
The **Routing n:n** function block is only needed to reverse the inversion of the **Multiple release** function block.

In this example, all inputs of the **Dynamic Weather Assist** function block are set to HIGH as soon as a HIGH signal is pending on the **Release** input of the **Multiple Release** function block. The signals of the monitoring fields of the safety laser scanner do not have an effect on the **Dynamic Weather Assist** function block.

### 4.2.5 Evaluation of monitoring fields for field set switching

Ideally, the two monitoring field are generated together in a field set with the other fields of the AGVs. In this case, all fields are evaluated simultaneously and no field set switching is necessary.

If you require field set switching, only signals of the monitoring fields from the active field set affect the function block inputs.

If you always use the same cut-off paths for the monitoring fields, no additional logic is required. If that is not possible, you can link the signals of the monitoring fields like in the following example.
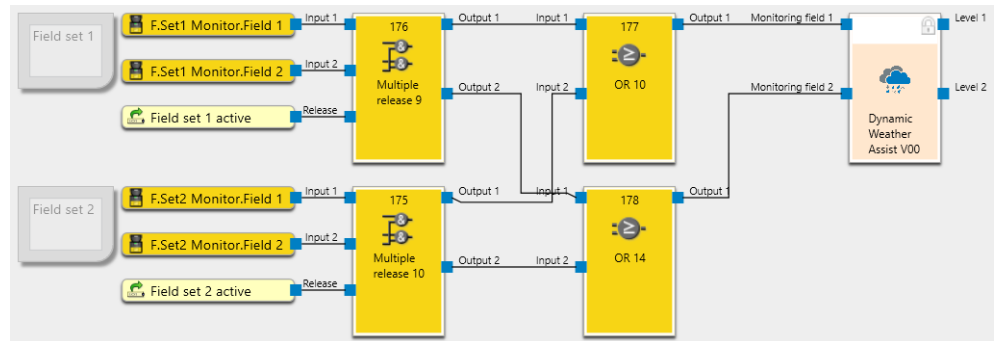
4.3 Requirements on monitoring fields

Requirements

Monitoring field 1
- Length of monitoring field: 4 m
- Width of monitoring field: Same width as the protective field (typically 1.5 m)
- Multiple sampling: 2×

Monitoring field 2
- Length of monitoring field: 2 m
- Width of monitoring field: Same width as the protective field (typically 1.5 m)
- Multiple sampling: 2×

These specifications assume that the monitoring field and the protective field are shaped like a rectangle. In some applications, a rectangular field is not possible, for example because the field of view of the safety laser scanner is limited by parts of the AGVs. In these cases, the monitoring fields should have the same shape as the protective fields, with the exception of the length.

Complementary information

The input signals for the function blocks are not safety-relevant. For better clarity, creating the monitoring fields with warning fields is ideal. If you comply with the requirements named here, you can in principle also use protective fields.

4.4 Requirements on protective fields

Important information

⚠️ **DANGER**
Disregard of requirements due to risk assessment

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

► Note that the requirements on the protective fields from the risk assessment and specific safety-relevant AGV parameters (e.g. braking distance) have priority over the requirements described here.

Requirements

"Fast" protective field
- Length of protective field: 2 m … 4 m
- Width of protective field: ≤ 4 m
- Multiple sampling: 4×

"Average" protective field
- Length of protective field: 2 m … 4 m (≤ of length of "fast" protective field)
- Width of the protective field: The same width as for the "fast" protective field.
- Multiple sampling: 8×

"Slow" protective field
- Length of protective field: ≤ 1.5 m
- Width of the protective field: The same width as for the "fast" protective field.
- Multiple sampling: 8× … 16×

4.5 Requirements for components

Required hardware

The Dynamic Weather Assist function block can only be used together with certain SICK hardware.

- Safety laser scanner: outdoorScan3 Pro – EtherNet/IP™
- Safety controller: Flexi Soft with FX3-CPU0 main module and EtherNet/IP™ gateway

Complementary information

There are part numbers which already contain the necessary hardware in addition to the function block.

Further topics

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5 Mounting

5.1 For mounting the components

NOTE
Information is included in the operating instructions for the components.

6 Electrical installation

6.1 Electrical installation of the components

> **NOTE**
> Information is included in the operating instructions for the components.

7 Configuration

7.1 Requirements for software and firmware

Table 6: SICK component versions

Software and firmware	Minimum version
Safety Designer	2023.01
Firmware FX3-CPU0	4.0
Firmware FX3-GEPR	1.04.0
outdoorScan3 Ethernet/IP™ firmware	1.0

7.2 Pre-configured project files

SICK provides you with the preconfigured project file in a ZIP archive when you purchase the software package. When opening the project file included for the Safety Designer configuration software, the Dynamic Weather Assist function block is imported. In the logic editor, the function block is available in the **CPU logic** area under **Function blocks** in the **Customized function blocks** group.
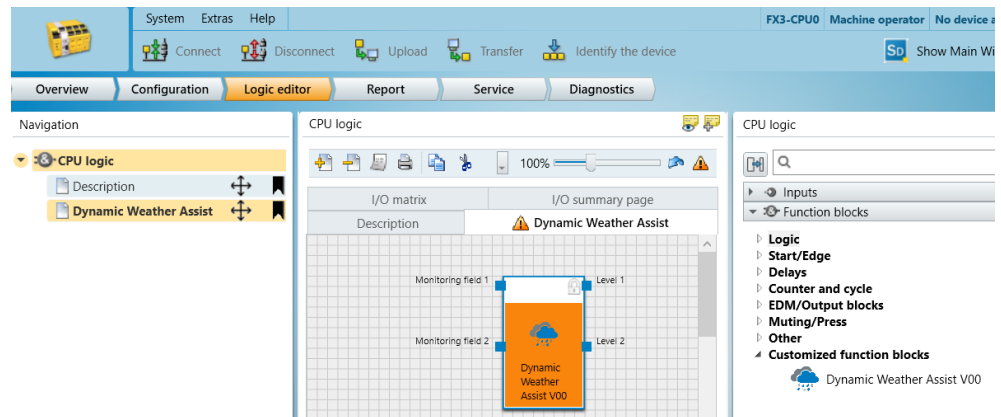
8 Commissioning

8.1 Safety

⚠️ **WARNING**
Hazard due to lack of effectiveness of the protective device

▶ Before commissioning the machine, make sure that the machine is first checked and released by qualified safety personnel.
▶ Only operate the machine with a perfectly functioning protective device.

⚠️ **DANGER**
Dangerous state of the machine

During commissioning, the machine or the protective device may not yet behave as you have planned.

▶ Make sure that there is no-one in the hazardous area during commissioning.

Before commissioning can be performed, project planning, mounting, electrical installation and configuration must be completed in accordance with this document.

8.2 Check during commissioning and modifications

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

▶ Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

9 Operation

9.1 Operating the components

> **NOTE**
> Information is included in the operating instructions for the components.

10 Maintenance

10.1 Maintenance of the components

ℹ️ **NOTE**
Information is included in the operating instructions for the components.

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11 Troubleshooting

11.1 Troubleshooting the components

> **i** **NOTE**
> Information is included in the operating instructions for the components.

12   Ordering information

12.1   Scope of delivery

Table 7: Scope of delivery

Component	Software package	Hardware package 1	Hardware package 2
Dynamic Weather Assist function block for importing into Safety Designer project	1 ×	–	–
outdoorScan3 Pro – EtherNet/IP™ safety laser scanner	–	1 ×	2 ×
Flexi Soft safety controller • FX3-CPU0 main module • FX3-GEPR0 gateway • FX3-MPL0 system plug	–	1 ×	1 ×
Operating instructions	1 ×	–	–

12.2   Ordering data of Dynamic Weather Assist AGV

Ordering data of Dynamic Weather Assist AGV

You must order the hardware and software separately.

Table 8: Ordering data of Dynamic Weather Assist AGV hardware

Description	Part number
Hardware package 1 • 1 × outdoor- Scan3 Pro – EtherNet/IP™ safety laser scanner • 1 x Flexi Soft safety controller with main module, gateway and system plug	1114366
Hardware package 2 • 2 × outdoor- Scan3 Pro – EtherNet/IP™ safety laser scanners • 1 x Flexi Soft safety controller with main module, gateway and system plug	1114367

Table 9: Ordering data of Dynamic Weather Assist software

Description	Part number
Dynamic Weather Assist software	1615375

13 Spare parts

13.1 Dynamic Weather Assist spare parts

Table 10: Dynamic Weather Assist spare parts

Component	Type code	Part number
outdoorScan3 Pro – EtherNet/IP™ safety laser scanner	MICS3-CBUZ40IZ1P01	1094472
Flexi Soft safety controller - CPU0 main module	FX3-CPU000000	1043783
Flexi Soft safety controller - system plug for FX3-CPU0	FX3-MPL000001	1043700
Flexi Soft safety controller - EtherNet/IP™ gateway	FX0-GENT00000	1044072

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        1800 33 48 02 – tollfree
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