



DATA SHEET

REVISION HISTORY

Document Version	Description	Revision Date
0.1	Preliminary release	May 2021
0.2	Updated mechanical drawings <ul style="list-style-type: none">• Corrected D455e back view drawing• Added dimensions of hole pattern for mounting to all housed camera drawings	June 2021
0.3	Updated D455e mounting holes information	June 2021
1.0	Updated mechanical drawings to match drawings from user manual Added depth starting point for D415e, D435e and D455e Official release	August 2021
1.1	Updated operating and storage conditions.	October 2021
1.2	Added D435e-f and D455e-f variants. Updated mechanical drawings and depths start point for D435e.	August 2023



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1 INDUSTRIAL DEPTH CAMERA D400E SERIES

The FRAMOS Industrial Depth Camera D400e Series (D400e series) are built with Intel® RealSense™ technology. The depth cameras have industrial M12 ethernet and M8 power connectors. Its water and dust resistant housing is optimized for industrial environments. The D400e series are ideal for OEMs and integrators who need 3D as well as 2D vision in their products and applications. The D400e series are compatible with a modified version of the Cross-platform SDK for Intel® RealSense™ devices, enabling multiple programming languages, wrappers, sample code and tools. D435e and D455e camera models, featuring global shutter, wide field of view sensors, are especially suitable for applications with fast motion.

Features

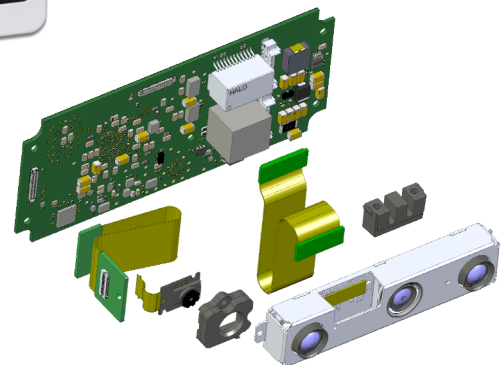
- Gigabit Ethernet data transmission
- Data transfer up to 100m in length
- Single cable for both power & data via PoE
- Increased data transmission reliability with packet resend
- Intel® RealSense™ SDK 2.0 compatible
- Onboard depth calculation with Intel® RealSense™ Vision Processor D4
- External Event Trigger Mode

Camera only

- IP66 dust and water-proof housing for industrial environments, IP67 on project basis
- Secure cable connections with threaded M12 and M8 plugs



D415e, D435e and D455e camera
(front to back)



D435e module variant



2 D400E SERIES SKUS

The D400e series consists of housed cameras (D400e cameras) and their respective board level modules (D400e modules).

Product order codes/ Item no. and availability:

	Cameras				Module Variant
	Camera Only		Starter Kit		
D415e	10009031	✓	10009030	✓	10009003 ○
D435e	10007930	✓	10007931	✓	10009344 ○
D455e	300433	✓	300432	✓	300820 ○
D435e-f	308233	✓	308232	✓	x
D455e-f	308235	✓	308234	✓	x

✓ Available
○ Available on project basis
x Not available

3 PACKAGE CONTENTS

3.1 Camera Only

- Respective camera without accessories

3.1 Starter Kit

- Camera
- M12 to RJ45 Ethernet cable, 2 m
- M8 to wall plug power supply cable, 2 m

3.1 Module Variants

- Intel® RealSense™ Stereo Depth Module
- Depth module cable bracket
- Depth module interposer (custom length possible)
- FRAMOS D4 Visual Processing Board
- D415e and D435e module variant only:
 - RGB module
 - RGB module cover
 - RGB module interposer (custom length possible)



4 D400E SERIES CAMERA HARDWARE SPECIFICATION

Model Name	D415e	D435e / D435e-f	D455e / D455e-f
<i>Housing material</i>	Aluminum, anodized		
<i>Housing grade</i>	IP66 (IP67 on project basis)		
<i>Protection glass</i>	AR coating, scratch resistant (6H)		
<i>Dimensions (L x H x W mm)</i>	100 x 47 x 38 (without connectors) 112 x 47 x 38 (with connectors)		132 x 47 x 41 (without connectors) 132 x 47 x 53 (with connectors)
<i>Camera weight (grams)</i>	~250	~250	~395
<i>Mounting holes (backside, mm)</i>	4 x M3 ↓ 3.2	4 x M3 ↓ 3.2	4 x M4 ↓ 5 (stainless steel thread inserts)
<i>Connector 1¹</i>	M12 ethernet, X-coded (Data stream, PoE)		
<i>Connector 2¹</i>	M8, 8 pin, A-coded (Power supply, GPIO)		
<i>Physical interface</i>	Gigabit ethernet		
<i>Main components</i>	Intel® RealSense™ depth module D410 RGB Module FRAMOS D4 Visual Processing Board	Intel® RealSense™ depth module D430 RGB Module FRAMOS D4 Visual Processing Board	Intel® RealSense™ depth module D450 RGB Module FRAMOS D4 Visual Processing Board
<i>Operating temperature (°C)²</i>	0 to 60 (housing temperature)		
<i>Storage temperature (°C)</i>	0 to 50 (ambient temperature, sustained, controlled) -40 to 70 (ambient temperature, short exposure)		
<i>Operating and storage relative humidity</i>	10 to 90% (non condensing)		
<i>Regulatory</i>	CE, FCC, RoHS, REACH IR projector: Class 1, IEC 60825-1:2007 Edition 2, IEC 60825-1:2014 Edition 3		
<i>Shock</i>	DIN EN 60068-2-27		
<i>Vibration</i>	DIN EN 60068-2-6, DIN EN 60068-2-64		

¹ For pin assignments please refer to the [D400e series user manual](#).

² Please refer to the [D400e series user manual](#) for details.



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5 D400E SERIES MODULE VARIANT HARDWARE SPECIFICATION

Model Name	D415e ¹	D435e ¹	D455e ¹
<i>Dimensions (L x H x W mm)</i>	Please refer to mechanical drawings section		
<i>Module variant weight (grams)</i>	~40	~40	~55
<i>Connector 1²</i>	Molex Pico Blade Standard Connector 53398-0871 (Data stream + PoE possible)		
<i>Connector 2²</i>	Molex Pico Blade Standard Connector 53398-0871 (Power supply + GPIO)		
<i>Physical interface</i>	Gigabit ethernet		
<i>Depth interposer length³ (total length / flex cable part, mm)</i>	100 / 90	100 / 90	100 / 90
<i>RGB interposer length (mm)³ (total length / flex cable part, mm)</i>	68 / 50	68 / 50	RGB module integrated in depth module
<i>Components</i>	Intel® RealSense™ depth module D410 RGB Module incl. cover FRAMOS D4 Visual Processing Board RGB module interposer Depth module interposer Depth module cable bracket	Intel® RealSense™ depth module D430 RGB Module FRAMOS D4 Visual Processing Board RGB module interposer Depth module interposer Depth module cable bracket	Intel® RealSense™ depth module D450 FRAMOS D4 Visual Processing Board Depth module interposer Depth module cable bracket
<i>Operating temperature (°C)</i>	0 to +50 (depth module housing temperature) Please refer to the Intel® RealSense™ Product Family D400 Series data sheet chapters 3.7.8 and 3.7.9 for additional details also valid for the FRAMOS D4 Visual Processing Board		
<i>Regulatory</i>	RoHS, REACH		

¹ D415e and D435e module variants require proper alignment between depth and RGB module. For all module variants it is recommended to perform OEM calibration with [Intel® RealSense™ D400 Camera OEM Calibration Target](#) to achieve best results.

² For pin assignments please refer to the [D400e series user manual](#).

³ Cable length of module samples. Custom cable lengths possible.



6 D400E SERIES FUNCTIONAL SPECIFICATION

Model Name	D415e	D435e / D435e-f	D455e / D455e-f
<i>Max resolution depth (px)¹</i>	1280 x 720 rolling shutter	1280 x 720 global shutter	1280 x 720 global shutter
<i>Max resolution RGB (px)¹</i>	1920 x 1080 rolling shutter	1920 x 1080 rolling shutter	1280 x 800 global shutter
<i>FOV depth (H x V °)¹</i>	65 x 40	87 x 58	87 x 58
<i>FOV RGB (H x V °)¹</i>	69 x 42	69 x 42	90 x 65
<i>Baseline depth (mm)¹</i>	55	50	95
<i>Projector¹</i>	Infrared (IR) laser projector system (Class 1 compliant) Unstructured light in IR spectrum to enhance depth quality		
<i>Min depth distance (Min-Z) at max resolution (cm)¹</i>	~45	~28	~52
<i>Optimal operating range (m)¹</i>	0.5 - 3	0.3 - 3	0.6 - 6
<i>Streaming speed</i>	30 fps simultaneous depth and RGB stream at 1280 x 720 px, other combinations of fps and streams with total bandwidth below 1Gbps		
<i>Inertial measurement unit (IMU)</i>	✓	✓	✓
<i>Optical Filter</i>	No	IR Pass (D435e-f only)	IR Pass (D455e-f only)
<i>Power consumption (W)</i>	7 (M8 Aux) 8 (M12 PoE)		
<i>Power supply M8 (V)</i>	12 - 24 (+/- 10%)		
<i>Power supply PoE</i>	Power sourcing equipment (PSE) compliant with standard IEEE 802.3af (802.3at Type 1)		

¹ For additional information on the performance and characteristics of the Intel® RealSense™ depth modules and Intel® RealSense™ Vision Processor D4 please refer to the official Intel® RealSense™ documentation: <https://dev.intelrealsense.com/docs>.



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Model Name	D415e	D435e	D455e
<i>Software</i>	FRAMOS Camera Suite SDK FRAMOS proprietary version of Intel® RealSense™ SDK 2.0 ¹		
<i>System requirements²</i>	Host PC operating system: <ul style="list-style-type: none">■ Microsoft® Windows® 10■ Linux Ubuntu 16.04, 18.04, 20.04■ NVIDIA® L4T 32.4.4 Host PC architecture: <ul style="list-style-type: none">■ X86_64■ ARM64 (NVIDIA® Jetson™)		
<i>Supported programming languages and wrappers²</i>	Python, ROS, ROS2, C/C++, C#, Intel® RealSense™ SDK 2.0 Viewer GUI		

¹ The FRAMOS proprietary version of the Intel® RealSense™ SDK 2.0 allows to recognize the D400e series and the USB depth cameras. Please contact support@framos.com for more information.

² Latest versions tested for each release are specified within the top level ReadMe files of the Software Packages that can be downloaded from the [FRAMOS website](http://www.framos.com).



7 D400E SERIES MECHANICAL DRAWINGS

All values are in millimeters [mm]. For CAD files contact your local sales representative.

7.1 D415e and D435e Cameras

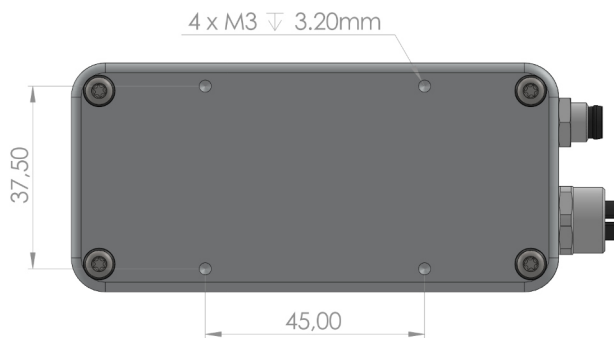
D415e front



D435e / D435e-f front



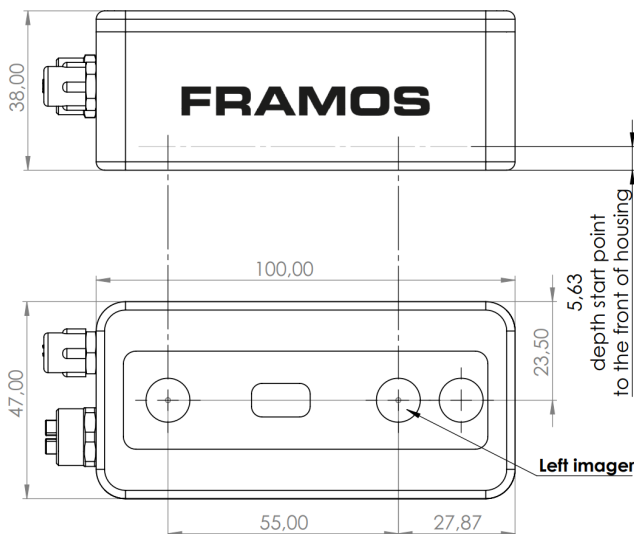
D415e and D435e / D435e-f back



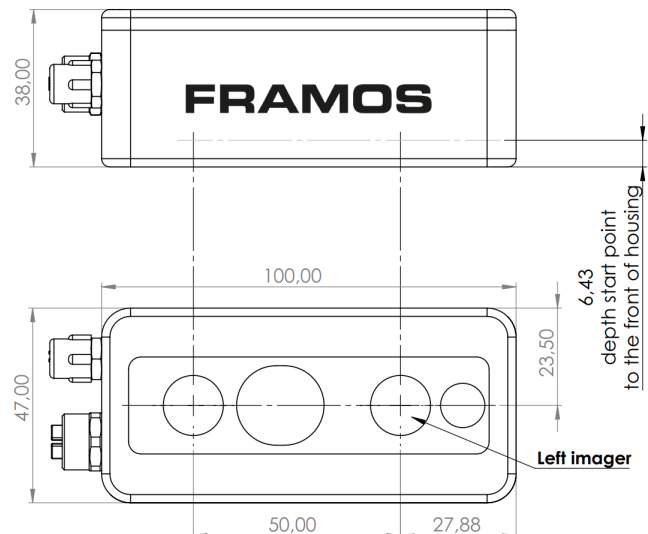
D415e and D435e / D435e-f side



D415e depth start point



D435e / D435e-f depth start point

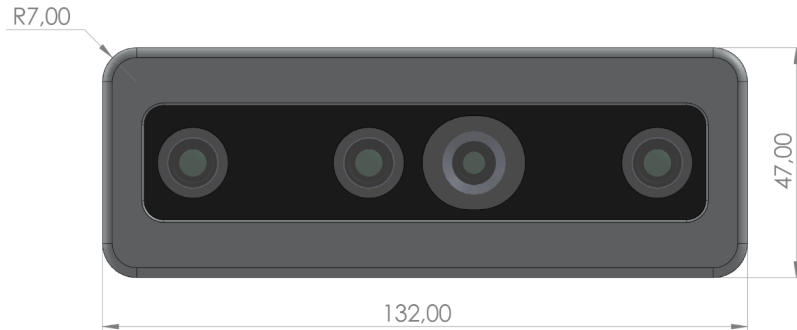




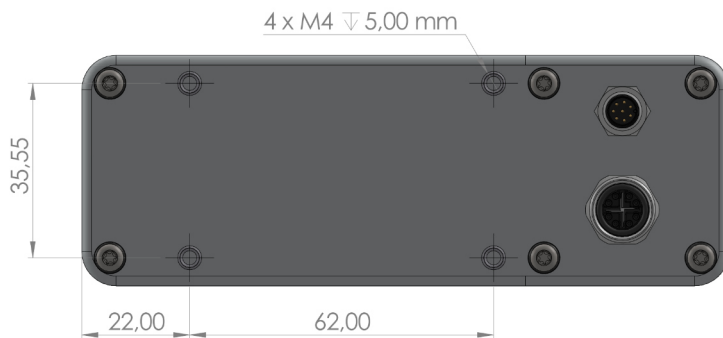
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7.2 D455e Camera

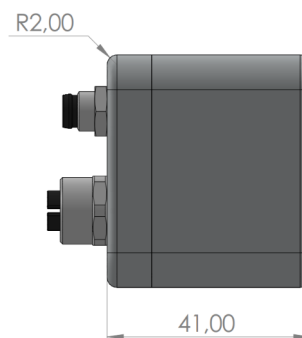
D455e / D455e-f front



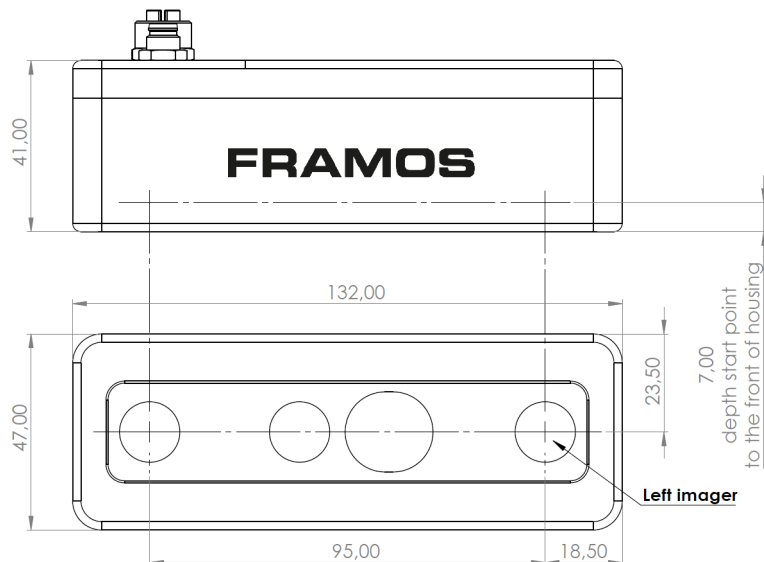
D455e / D455e-f back



D455e / D455e-f side



D455e / D455e-f depth start point



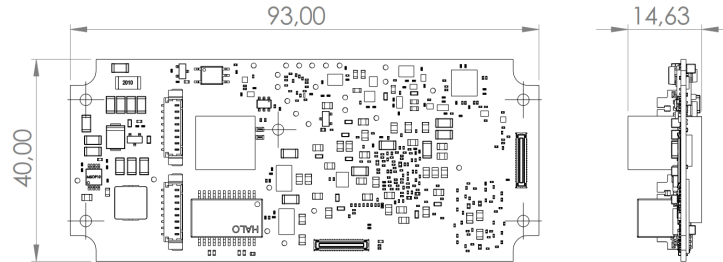


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7.3 Module Variant

FRAMOS D4 Visual Processing Board

Item no.: 10009340



HSF depth module interposer

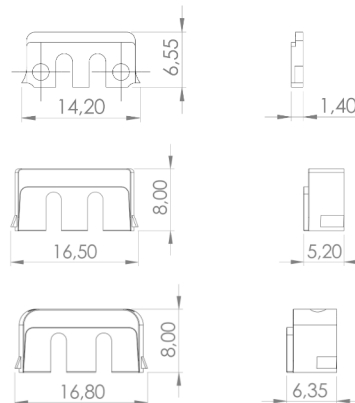
Item no. 100 mm: 10007414



Total cable length: 100 mm
Flex part length: 90 mm

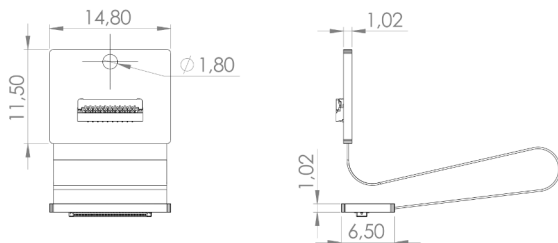
Depth module cable bracket

Item no. D415e: 10009342 (top)
Item no. D435e: 10009341 (middle)
Item no. D455e: 300821 (bottom)



RGB interposer

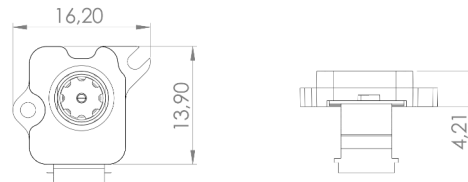
only D415e & D435e
Item no.: 10009331



Total cable length: 68 mm
Flex part length: 50 mm

RGB module incl. cover

only D415e & D435e
Item no. RGB module: 10009290
Item no. cover: 10009343

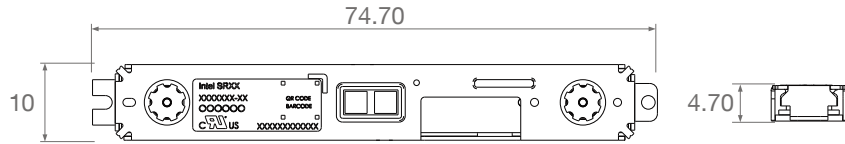




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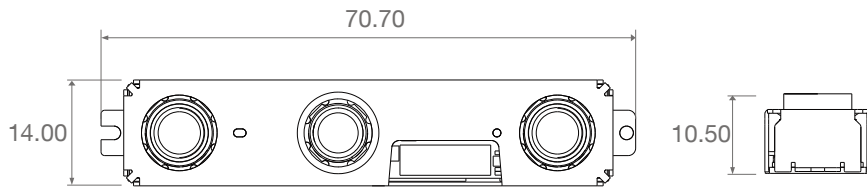
Intel® RealSense™ depth module D410 for D415e module variant

Item no.: 10006233



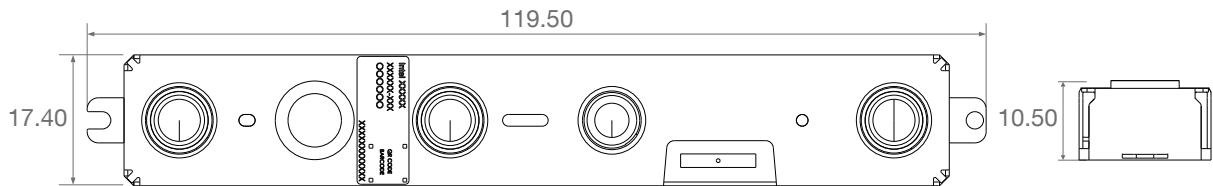
Intel® RealSense™ depth module D430 for D435e module variant

Item no.: 10006234



Intel® RealSense™ depth module D450 for D455e module variant

Item no.: 300054





8 USEFUL LINKS

Software and documentation, downloads for D400e series

www.framos.com/industrial-depth-cameras

- [User Manual](#)
- Application Notes
 - [Tuning System For Best Performance](#)
 - [External Event Camera Synchronization](#)
 - [Multi-Camera Synchronization](#)
 - [High Dynamic Range with Stereoscopic Depth Cameras](#)



D400e series knowledge base

www.framos.com/industrial-depth-cameras/kb



Intel® RealSense™ Documentation

<https://dev.intelrealsense.com/docs>