DATALOGIC

HALOGEN™ DE2171-AF

Auto Focus Extra Long Range 2D Bar Code Scan Engine



Integration Guide

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Patents

See www.patents.datalogic.com for patent list.

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Chapter 1
Introduction

About this Manual

This Integration Guide is provided to give instructions, opto-mechanical details and design considerations for integrating the HALOGEN™ DE2171-AF scan engine (designated as "scan engine" or "OEM scan engine" in this manual) specifically into equipment-integrated scanning applications.

DE2171-AF supports two different interfaces on the host connector:

- TTL-UART
- USB (COM, Keyboard, OEM, Composite)

In the following chapters, those models will be described in detail along with mechanical and electrical characteristics. Unless otherwise specified, they will be referred to as DE2171 engines.

Manual Conventions

The following conventions are used in this document:

The symbols listed below are used in this manual to notify the reader of key issues or procedures that must be observed when using the reader:



Notes contain information necessary for properly diagnosing, repairing and operating the reader.



The CAUTION symbol advises you of actions that could damage equipment or property.

Outline

Chapter 1, Introduction presents information about manual conventions, an overview of the engine and its features and operation.

Chapter 2, Installation provides information about unpacking, scan engine connection and setting up the scan engine for optimum performance.

Chapter 3, Electrical Integration offers information about electrical components.

Appendix A, Technical Specifications lists physical and performance characteristics, as well as environmental and regulatory specifications.

Appendix B, Engine Video Format details signal characteristics and timing of the camera interface.

Technical Support

Support Through the Website

Datalogic provides several services as well as technical support through its website. Log on to (www.datalogic.com).

For quick access, from the home page click on the search icon, and type in the name of the product you're looking for. This allows you access to download Data Sheets, Manuals, Software & Utilities, and Drawings.

Hover over the Support & Service menu for access to Services and Technical Support.

Reseller Technical Support

An excellent source for technical assistance and information is an authorized Datalogic reseller. A reseller is acquainted with specific types of businesses, application software, and computer systems and can provide individualized assistance.

About the DE2171-AF

The Datalogic DE2171-AF is a compact, high performance, extended range autofocus scan engine used to capture digital images, decode linear and 2D symbologies and transfer the data to an external digital platform.

Unpacking the Scan Engine

The scan engine is shipped in custom packaging. Carefully open the package, and inspect the scan engine.

If any parts are damaged or you need additional hardware, please contact Technical Support.

Scan Engine Care

The scan engine contains sensitive components which require special handling. Datalogic may not warrant damage due to improper handling.

- Do not disassemble the scan engine. Doing so will void the warranty.
- Use standard ESD precautions & policies when handling the DE2171-AF scan engine.

External Optics

The engine has an illumination system with two exposed projection lenses on the outer front surface. Take care of this optical components, preserving the lenses from mechanical stress that can damage them. Avoid touching the optical surfaces to preserve the optical performance.

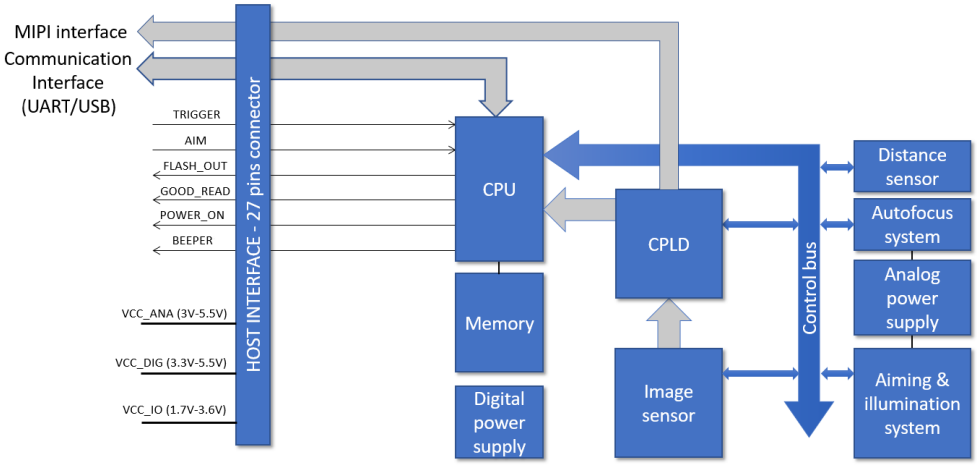
System Overview

The Datalogic DE2171 scan engine features a global shutter sensor having 1280x960 pixels, operating with a frame rate of 50 images per second and it is based on a Microchip ARM A5 processor to capture and decode images.

The engine contains an embedded illumination system and an aiming system. The high performance, low power micro-controller runs the engine system and handles communication with the external host. The host interface is available as a 27-pole 0.5mm pitch ZIF connector.

Electrical interface on the connector is the same for all models and additionally supports, if activated, MIPI video port simultaneously with the communication interface (see Chapter 3).

Figure 1. Engine Block Diagram



Illumination System

The Illumination System is composed of two LEDs and projection optics designed to provide first-class reading performances, even in total darkness.

Regulatory

- EN/IEC 62471 Exempt Risk Group

Aiming System

The aiming system is based on a 650nm laser diode and a collimation lens. It projects a highly visible spot also at extended distances. The Laser beam has a diameter of 1mm at 1m and approx. 10mm at 10m.

The engine has an aiming mode which powers the laser in pulsed and continuous mode to enhance long distance visibility.

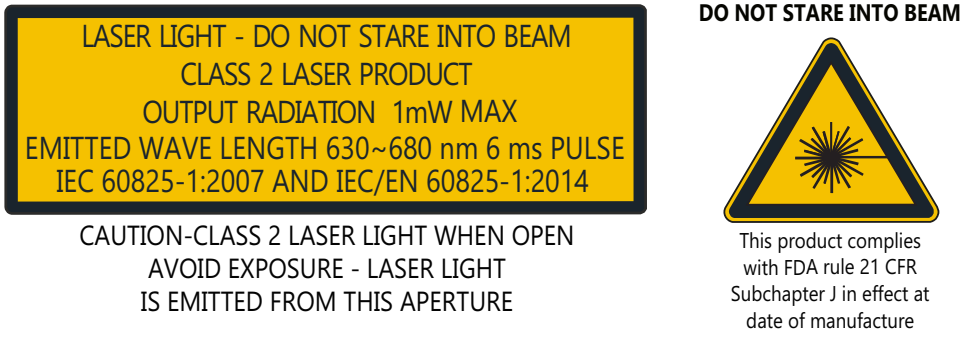
Aiming System Parameters

Wavelength	645–660 nm
Beam Divergence	0.05°
Pulse duration in pulsed mode	6 ms
Pulse repetition rate in pulsed mode	20 ms
Maximum output power	1mW
Laser aperture	1.5 mm

Regulatory

- EN/IEC 60825–1:2007 and 2014 (class 2)
- 21 CFR 1040 (CDRH) (class II)

Figure 2. DE2171 Regulatory label



TOF

Time of flight system is based on a laser source at 940 nm, which enables short distance measurements.

Regulatory

* EN/IEC 60825–1:2007 and 2014 (class 1)

Chapter 2
Installation

This section describes how to correctly integrate the scan engine for optimal performance.

Mounting the Scan Engine

General Considerations

A typical system uses the scan engine mounted inside a host enclosure, with an opening for the illumination system light to exit and illuminate the label and for reading bar codes. The opening should be the size of the scan engine field of view at a minimum, but only exposing as much of the scan engine as necessary.

It is important to consider the effect of the environment on the scan engine. Mounting should avoid the possibility of foreign objects coming into contact with the electronics or optics. Such contact could damage the device or reduce the scan engine's performance.

Mechanical Size

Nominal size:

38.00mm (width) x 20.00mm (height) x 36.50mm (depth)

Maximum size:

38.50mm (width) x 20.00mm (height) x 36.50mm (depth)

Figure 3 - Overall View

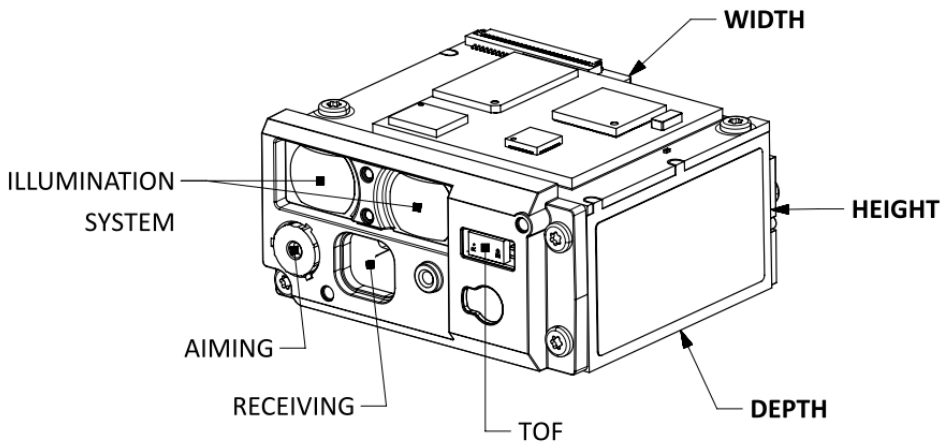
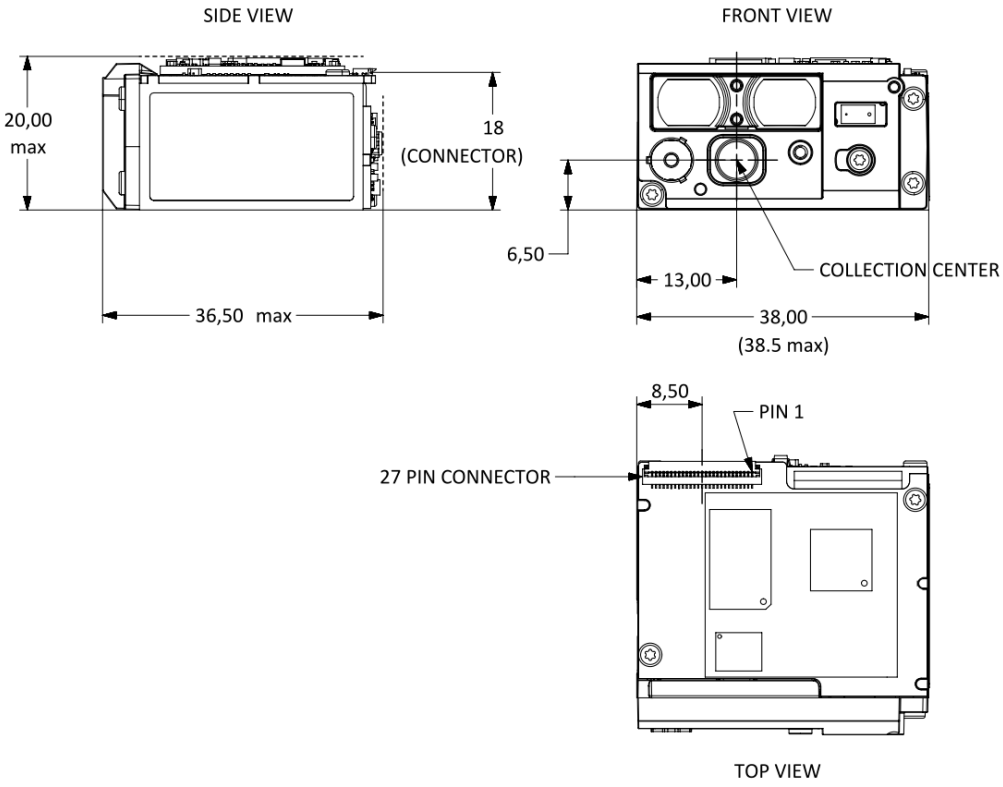


Figure 4 - Overall Dimensions and Connectors Position



Mounting Holes

There are four fixing holes M2 located on the bottom of the chassis. The recommended engagement for the screws is 2.4mm max., with a mounting torque of 30 cN m. For precise positioning, the chassis has two additional centering holes of Ø1.50±0.05mm at the bottom surface.

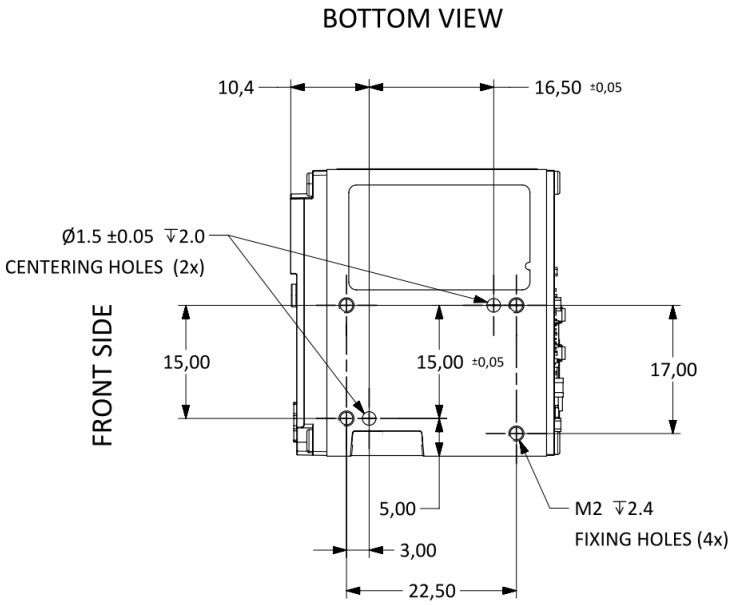
CAUTION

Consider that the scan engine chassis is connected to ground. Ensure it is isolated from VCC.

Use only non-magnetic screws or locating pins when mounting the DE2171.

Do not place magnetic or ferrous material (e.g. dynamic speakers, ringers, vibrators, inductors, metal parts) within 2cm from the chassis. The DE2171 powers a linear solenoid motor for the Auto Focus actuator. Altering the magnetic field can influence the engine's performance.

Figure 5 - Fixing and Centering Holes



Housing Design

The enclosure must be designed to prevent internal reflections from illumination and aiming systems into the receiving optics. Additionally, any cross talk between emitter and collector of the Time of Flight sensor due to reflections on the exit window must be avoided.

The exit window must be properly positioned and tilted and, if necessary, mounted an additional baffle to avoid reflections that could limit engine performance, for decoding, image capture and distance measurement.

Guidelines for Exit Window Positioning

There are two options for positioning the exit window with respect to the scan engine:

- Very close and parallel to the engine's front surface
- Close to the scan engine parallel or tilted and with an additional baffle.

Distances are measured from the front surface to the external face of the exit window (most distant from the engine) along the optical receiving axis. Window thickness should be smaller or equal to 1.5mm and with an Anti-Reflection coating on both sides.



- For baffle design, or if Time of Flight sensor calibration is needed in a specific design, please contact technical support.
- Integration tolerances are not included.

Figure 6 - Exit Window Positioning without Baffle

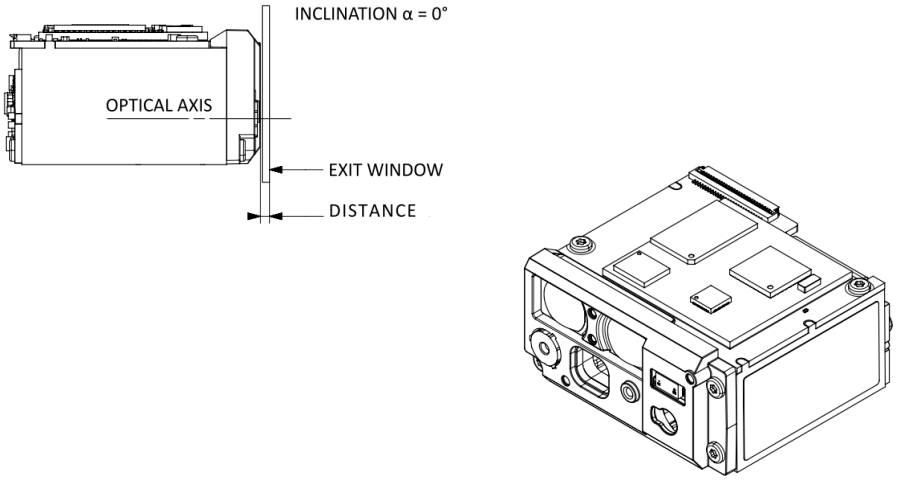


Figure 7 - Exit Window Positioning with Baffle - examples

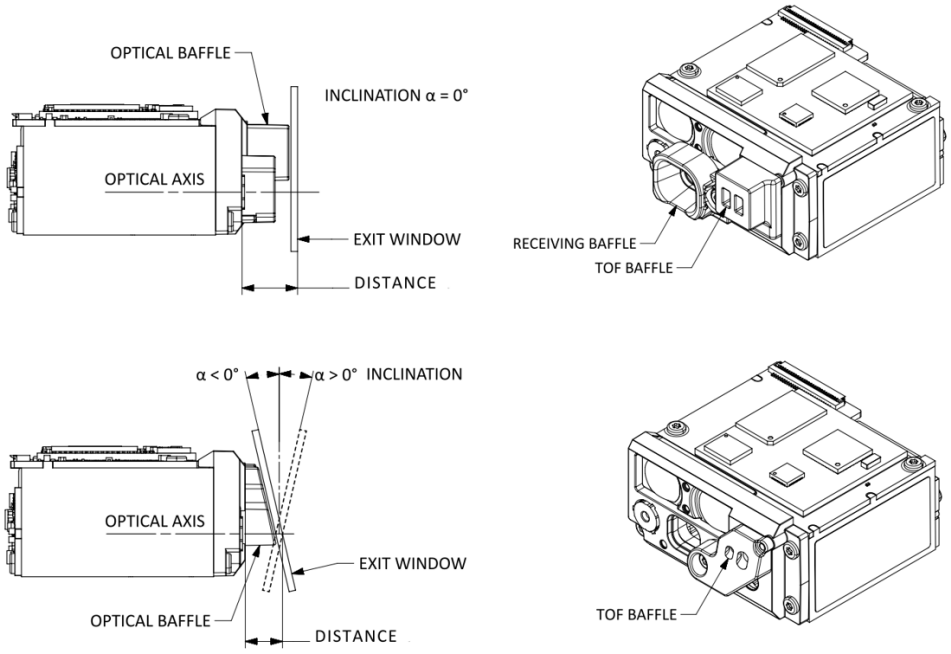
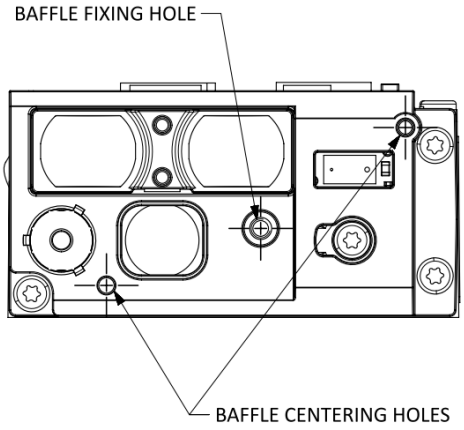


Figure 8 - Mounting Holes for Baffle



FIXING HOLES for OPTIONAL BAFFLE

Table 1 - Exit Window Positioning

	without baffle	with baffle TOF only	with baffle TOF and Receiving
distance	max. 2mm	max. 6mm	max. 8mm
inclination	0° ±1°	-15° to -3°	-15° to +10°

Avoiding Scratched Windows

Scratches on the exit window can strongly affect the reading performance. It is recommended to use an exit window having a scratch-resistant coating and to position the engine window in a recessed position.

Window Material

The exit window is an integral part of the imaging system and should be designed and selected to preserve the optical quality of the system. It is recommended to use only cell-cast plastics or optical glass.

Common materials and their characteristics are shown in Table 2.

Table 2. Exit Window Materials

Properties	PMMA (cell cast acrylic or polymethyl methacrylic)	CR39 (Allyl Diglycol Carbonate)
Optical Quality	Very good	Very good
Surface Hardness	Hard coating required	Hard coating required
Impact Resistance	Good	Good
Chemical / UV Resistance	Susceptible	Susceptible
Ultrasonically Welding	Compatible	Compatible

Exit Window Properties

Recommended properties/performance of the exit window are reported in Table 3 below.

Table 3. Exit Window Properties

Characteristics	Requirement
Material	PMMA or CR39 or equivalent
Thickness	1.5mm
Wavefront distortion	0.2 wavelengths peak-to-valley maximum and 0,04λ maximum rms over any 2.0mm diameter within the clear aperture
Clear aperture	To extend to within 1.0mm of edges all around
Surface quality	60/20 scratch/dig
AR coating	•double sided •transmittance > 95% minimum within spectrum range 400nm-700nm. •Transmittance: >70% at 940nm. •Reflectance of both surfaces: 1% max. in the range 640nm-660nm

Optical Paths and Exit Window Clearance

Figure 9, 10 and 11 show the optical paths of the illumination system, the receiving and aiming system and the time of flight sensor.

Declared imaging system Field of View is 14° horizontal x 10.5° vertical (see Appendix A). Due to fabrication and assembly tolerances, the keep out angle to be considered for mechanical integration is 16° x 12°.

Figure 9 - Illumination Optical Paths

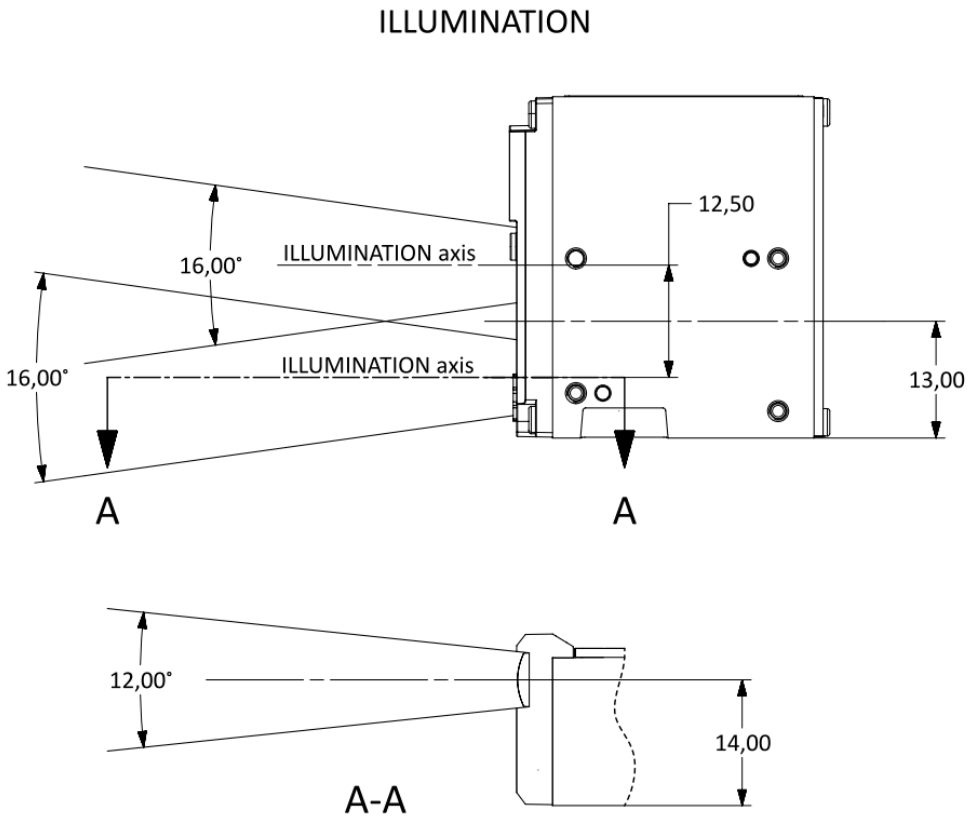


Figure 10 - Receiving and Aiming Optical Paths

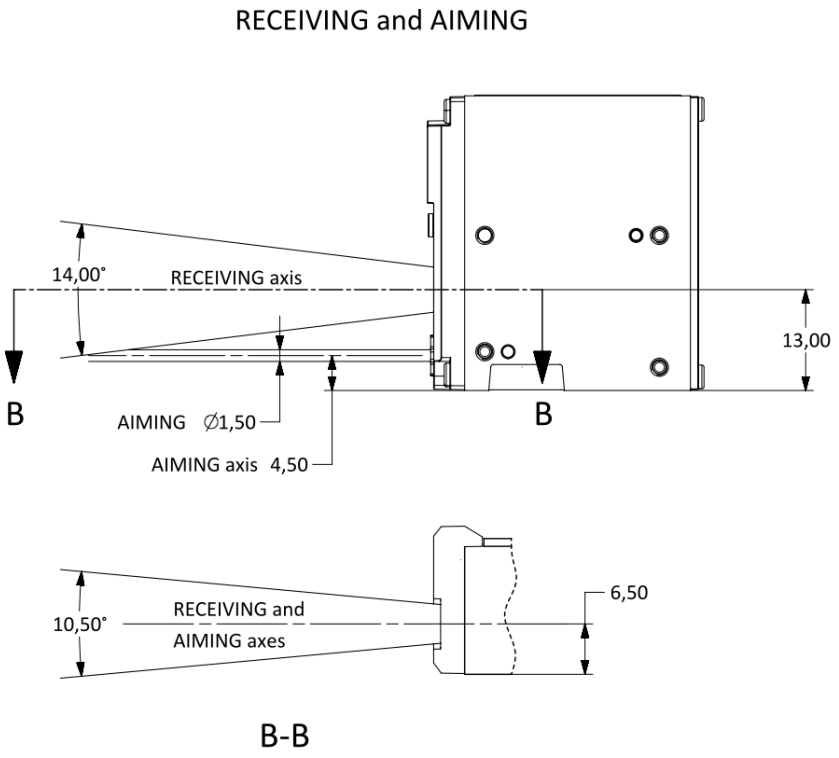
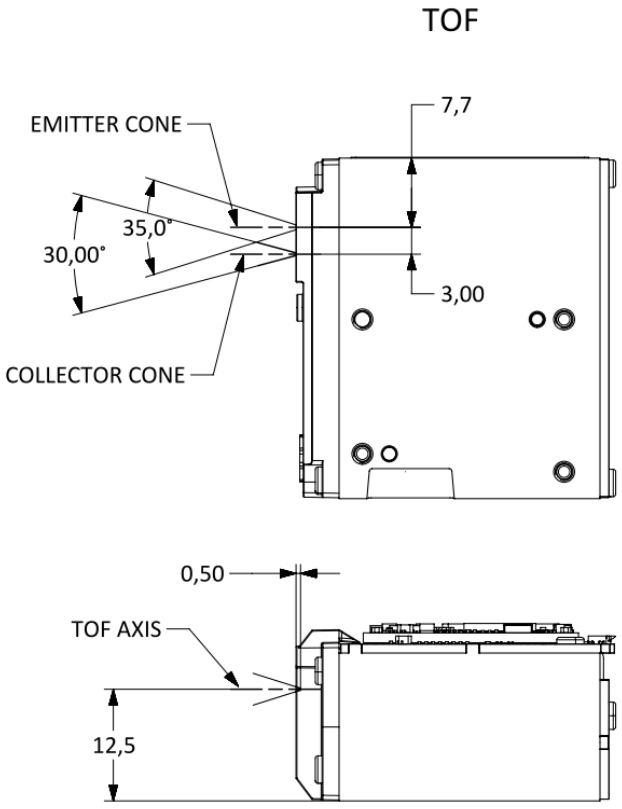


Figure 11 - Time of Flight Sensor Optical Path



Environment

Dust on the optical parts of the engine can badly affect the performance of the scan engine. Ensure the engine is clear of dust and water when integrating it inside the housing.

Chapter 3
Electrical Integration

Electrical Connections

Grounding

The chassis of the engine is at ground. Mounting screws can be used to implement additional connections to the host ground.

Based on the host characteristics, the additional ground connections can affect:

- the engine performance (if noise is injected into the scan engine)
- the radiated emission (depending on current loops)

It is suggested to investigate these topics at the beginning of the integration.

ESD

The engine is protected from ESD up to ±2.0KV on the connector.

During installation, it is recommended to apply standard ESD handling procedures, such as operating in a properly grounded working area using wrist straps.

Electrical Interface

The DE2171 scan engine can be connected to an external digital platform via a 27-pole 0.5mm pitch ZIF connector, supporting:

- decoded information transmitted by means of TTL UART interface (referred to as decoded UART).
- decoded information transmitted by means of USB COM, HID Keyboard, composite or OEM interface (referred to as decoded USB).
- a camera interface MIPI-CSI2, supported to be simultaneously active with one of the above listed communication interfaces.

Table 4 describes the power lines and the signals mapped on the 27-pole ZIF connector.

Figure 12 Connector Position and PIN 1 Location

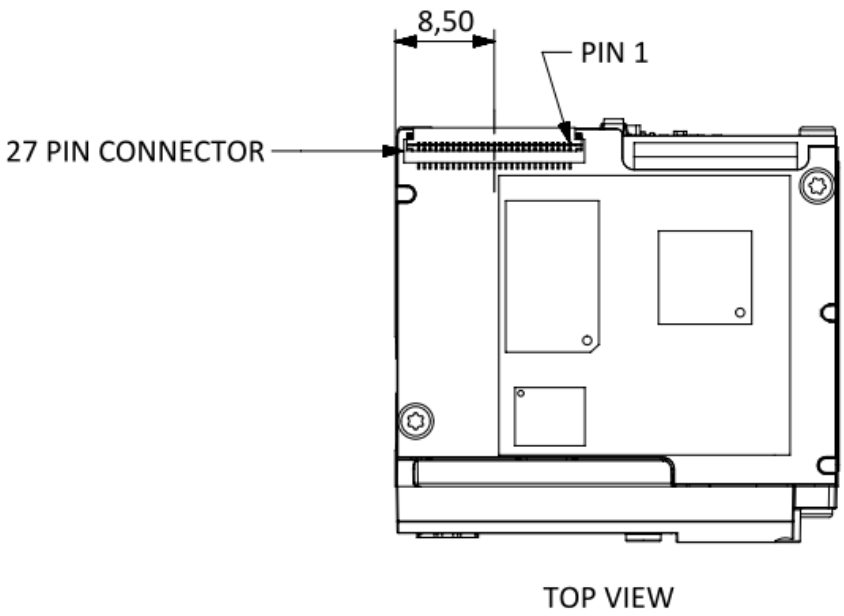


Table 4 - Electrical Interface of the Host Connector

Pin	Signal UART	I/O type	Description
1	GND	power	Main Power Supply Ground
2	USB DP	I/O	USB main interface positive
3	USB DN	I/O	USB main interface negative
4	GND	power	Main Power Supply Ground
5	UART_RX	I/O	UART TTL receiving
6	UART_TX	I/O	UART TTL transmitting
7	UART_CTS	In	Input UART TTL Clear to Send
8	UART_RTS	I/O	Output UART TTL Ready to Send
9	BEEPER_CTRL	Out	Beeper activator signal
10	EXT_ILLUM	Out	EXTERNAL ILLUMINATION control
11	GOOD_READ_LED	Out	Output digital control signal for an external LED to indicate the good decode (GreenSpot)
12	TRIG_CTRL	In	Scan session start and stop. A positive edge triggers the reading session, a negative edge ends it.
13	AIM_CTRL	In	Aiming mode control and wake-up signal. When the scan engine is in idle state, a positive edge activates the aiming functionality. A negative edge deactivates aiming mode and scan engine goes back to idle state. It is also used to wake up the scan engine when in low power state. A positive level wakes up the scan engine that goes back to idle state.

Pin	Signal UART	I/O type	Description
14	VCC I/O	power	Power for I/O interface from 1.7V to 3.6V. All input signal voltage level must follow the voltage level of this power supply. All output signals have the voltage level applied to this pin.
15	VCC	power	Digital power supply from 3.0 to 5.5V. The power up voltage must be greater than 3.2 V. After the power up sequence, the VCC voltage can drop down to 3.0 V.
16	PWR_ON_CTRL	I/O	System Ready output signal and input signal for UART forced selection. When this signal is high, it indicates that the engine is operative. A low signal level indicates that low power state is active. During the system boot this pin can also behave as an input. If during the startup sequence the Host drives it at low level (see Electrical Interface paragraph), the scan engine is forced to boot in UART mode. Line is open-drain with a weak internal pull-up during startup phase (active pull-up current between 0.03mA and 0.3mA). After power up this line must not be driven from external logic.
17	VCC ANALOG	power	Power supply used for illumination power and Motor power. Shorted to pin 18. Both pins must be powered to provide the required current for the analog units.
18	VCC ANALOG	power	Power supply used for illumination power and Motor power. Shorted to pin 17. Both pins must be powered to provide the required current for the analog circuits.
19	GND	power	Main Power Supply Ground
20	MIPI CN	Out	MIPI-CSI2 differential clock lane (negative)
21	GND	power	Main Power Supply Ground
22	MIPI CP	Out	MIPI-CSI2 differential clock lane (positive)
23	GND	power	Main Power Supply Ground
24	GND	power	Main Power Supply Ground
25	MIPI DP	Out	MIPI-CSI2 differential data lane (positive)
26	GND	power	Main Power Supply Ground
27	MIPI DN	Out	MIPI-CSI2 differential data lane (negative)

Connector and Flat Cable (Host Interface)

The HALOGEN DE2171-AF scan engine is equipped with a 27-pole ZIF connector.

The host connector is 27-pole ZIF connector 0.5 mm pitch made for 0.2 mm thick flat cables.

Two compatible connector part numbers are:

- KYOCERA 006299027010846+
- HIROSE FH19C-27S-0.5SH (99)

Example part number for flex cable:

- Flexconn HCC27-35(3/5)6-T2TB

Supply Voltages and I/O Levels

The DE2171 scan engine is powered via a 27 pin ZIF connector on dedicated pins. The engine requires three different power supplies for the different internal power rails, VCC, VCC_ANALOG and VCC I/O.

In order to guarantee the correct operation of the engine, it is mandatory to use the following power-up sequence timing constraints:

- VCC, VCC I/O and VCC_ANALOG can be given to the engine at the same time. It is possible to give the VCC_ANALOG and VCC I/O before VCC that shall be the last one. If given the VCC as last, the sequence order for VCC_ANALOG and VCC I/O does not matter.
- The power off sequence is the opposite order. VCC, VCC I/O and VCC_ANALOG can be switched off at the same time or the first to be switched off shall be the VCC.



CAUTION

HOT-plugging can damage the engine. Be sure the power is cut-off before connecting or disconnecting the flexible cable.

Table 5 shows supply voltages and I/O levels

Table 5 - Supply Voltages and I/O Levels

Item	Level	Description
VCC	3.0V – 5.5 V	The device full operation is guaranteed in this range of voltage (compatible with USB powering). Important note: This power can go as low as 3.0 V, but at power-up, the minimum allowed voltage is 3.2 V, in order to guarantee the proper system startup.
VCC ANALOG	3.0 – 5.5 V	The illumination and motor power source can be connected to a power supply independent from VCC, if desired. Important note: Engine default is to respect 500mA max power consumption when powered by USB (5V). For power supplies <4.5V with higher current limit a specific configuration command must be sent to the engine.
VCC I/O	1.7V – 3.6V	Power for I/O interface. All input signal voltage levels must follow the voltage level of this power supply. All output signals have the voltage level applied to this supply.
I/O LEVEL	VOH typical = VCC I/O	The driving capability of the output pins is **4 mA max**. The internal engine digital supply is 3.3 V. The I/O output voltage is the same as VCC I/O. If the main power VCC is not applied the input pins cannot be driven.
MIPI LP signals	1.2V	The typical high level for MIPI lines (MIPI CLKP, CLKN, DP, DN) when in MIPI Low Power mode.
MIPI HS signals, Peak to Peak	0.2V	The typical signal peak to peak level for MIPI lines (MIPI CLKP, CLKN, DP, DN) when in MIPI High Speed mode.
MIPI HS signals, Common Mode	0.2V	The typical signal common mode level for MIPI lines (MIPI CLKP, CLKN, DP, DN) when in MIPI High Speed mode.

Power-up Sequence

The DE2171 starts a boot sequence once the VCC power supply voltage reaches 3.2 V typical.

Input signals can start at a high level but must be kept low until VCC I/O is stable. If external pull-ups are used, they can be connected to VCC I/O (limited to max V_IO = 3.6V).

The total boot sequence from boot start needs Tb = 1100ms, after that period the engine is ready to parse commands. This event is signaled by the rising edge of POWER_ON_CTRL signal that will stay high until power-off or until the engine enters the low-power state.

For UART configuration, POWER_ON_CTRL stays low during initialization until the engine is ready.

For USB configurations, POWER_ON_CTRL is an input during initialization phase and can be driven LOW to force UART configuration instead of the current one. In this configuration POWER_ON_CTRL signal level must be ignored before time Tc. The scan engine is ready only when POWER_ON_CTRL signal rises high for the first time after time Tc.

To use this smart configuration feature, POWER_ON_CTRL signal must be kept LOW until time Tc. POWER_ON_CTRL signal should never be driven HIGH before time Tc and should not be driven at any level after time Tc because it becomes a push-pull output of the module after that time.

After a configuration switch from USB to UART caused by keeping the POWER_ON_CTRL LOW, the module will not make any further checks on the signal during subsequent boots and will use UART interface until a barcode switch.

If this feature is needed, the optimal solution for power consumption is to drive POWER_ON_CTRL with the described sequence once and keep it as an input or open-drain afterwards. A simpler solution is to add a 4.7kOhm pull-down resistor on POWER_ON_CTRL pin.

Table 6 - Power-up Sequence Timing Constraints

Time	Descritpion	Value
Tc	Initialization time: POWER_ON_CTRL can be driven LOW and its output value must be ignored for USB configurations	800ms
Tb	Boot time: after this time POWER_ON_CTRL goes HIGH and the engine is ready to operate	1100ms

USB Powered Host and USB Interface Design Recommendations

If the engine is being integrated on a USB powered system, it is recommended to ensure that the host does not exceed the plug-in USB in-rush limits; if so, the host shall provide additional soft start circuitry to limit this current peak. This obviously would increase the Ts power up time, of a value depending on the host circuitry design.

Moreover, if USB communication interface is being used, additional standard USB protection for electrical immunity and adaptation shall be applied to USB D+ and D- lanes on Host PCB.

Power Supply Noise

In order to preserve image quality (both for decoding and image capture applications), a low-noise power supply is required.

The requirement for the power supply peak-to-peak noise is ≤150mV on all three power supply lines, the lower the better.

Note that Image quality depends also on the noise frequency.

Heat Dissipation

If the scan engine is operated in a closed environment where the temperature can rise significantly, particular care must be taken to properly dissipate the heat generated by an intensive operative condition, like using RUNNING mode with AIM and LED at full power continuously for an extended time.

The chassis is the thermal dissipator for the scan engine.

Engine Operation

The engine features four operating states to improve power consumption, activated sending commands through the control interface or by changing input signals.

Table 7 - Power States

State	Description
LOW POWER	Mode for energy saving: the engine is in a state of sleep and most of the internal circuitry is disabled. Low power consumption. About 15ms are required for wake up.
IDLE	The engine is waiting for commands, all systems ready for starting acquisition. Illumination is turned off, motor is keeping last focus position, moderate power consumption.
OPERATING	The engine illumination is turned on; the engine is continuously acquiring and decoding images. All systems are working, full power consumption.
AIMING	Mode with Laser aiming beam activated.

The engine in IDLE state (default trigger mode) starts the acquisition and decoding phase (entering OPERATING state) by changing the state of the TRIG_CTRL signal from low to high, or issuing a DESP "Start" command through the communication interface. If an image is decoded and the engine is configured appropriately, GOOD_READ_LED and BEEPER_CTRL output signals are activated and the engine steps back to the IDLE state. TRIG_CTRL and AIM_CTRL are digital signals. If they are connected directly to external buttons, proper debouncing circuits are needed.

When UART interface is selected: The engine can be put in LOW POWER state by issuing a DESP command "Suspend" through the UART interface. While in low power, AIM_CTRL signal must be kept LOW for correct operation.

To wake up, the engine needs one of the following actions:

- a high level on the AIM_CTRL signal. In order to avoid the start of aiming mode, set the AIM_CTRL signal right back to low. Minimum duration of positive pulse for wake-up is Tmin (see figure).
- Motion detected by accelerometer sensor, if configured.

When USB interface is selected: the engine will go to LOW POWER mode when the host puts the USB port in suspend and no command is required.

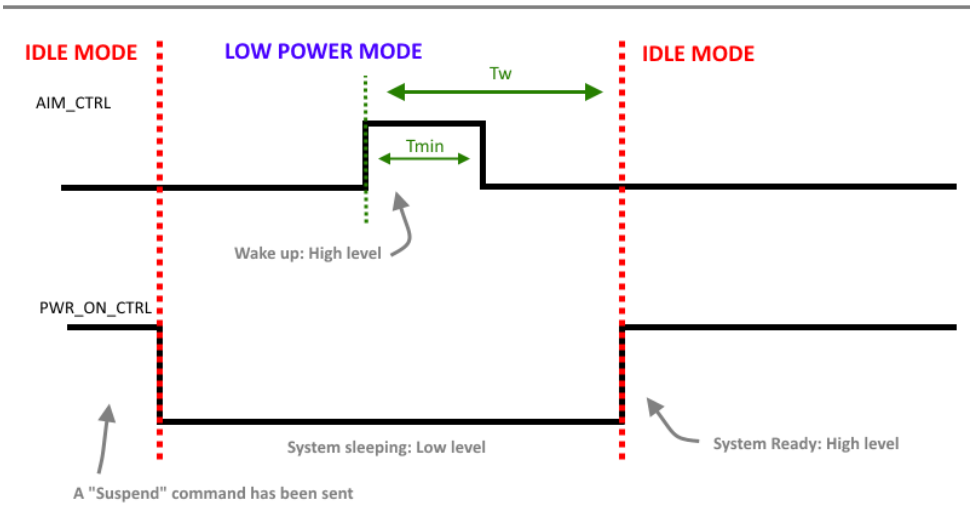
When the host resumes the USB port, the engine will go back to IDLE mode, in this case the DESP "Suspend" command is disabled.

For every interface, the LOW POWER state is indicated to the output interface by setting low the PWR_ON_CTRL signal. If the signal PWR_ON_CTRL is high the engine is either OPERATING or IDLE.

In the following figure a simplified sequence as an example is shown: the minimum time before reacting to trigger after a wake-up edge is Tw.

Last focus position is lost when the engine is brought into LOW POWER mode. Additional time is required during the first decoding run to recover best focus position.

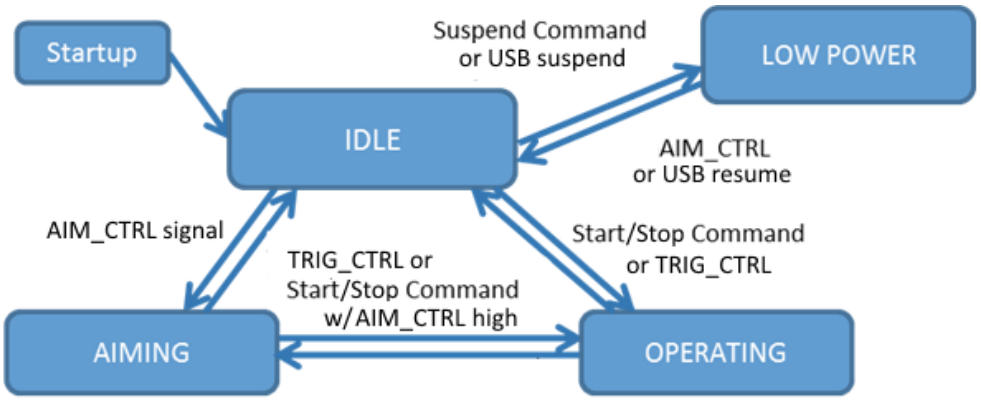
Figure 13 - Wake Up Sequence



Item	Descritpion	Value
Tw	Wake up time from low power to idle	≅15 ms
Tmin	Minimum pulse for a wakeup event to be recognized	≅100 ns

State transition sequences and corresponding inputs with also the AIM mode are described in the diagram of Figure 14.

Figure 14 - Working State Diagram



The timing for all transitions is described in Table 8, where it is also noted when a transition to IDLE is recommended.

Table 8 - State Transition Time

CURRENT STATE		NEW STATE			
		LOW POWER ↑	IDLE ↑	OPERATING ↑	AIMING ↑
LOW POWER	→	-	15 ms	-	-
IDLE	→	<1 ms	-	2 ms	<1 ms
OPERATING	→	-	max 20 ms*	-	max 20 ms*
AIMING	→	-	<1 ms	max 6 ms*	-

(*) dependent on sensor state and engine configuration

In Always ON mode the illumination and aiming are switched on continuously, and the scan engine is decoding. A successful decoding doesn't switch the engine to IDLE state.

The engine operation starts when setting the signal TRIG_CTRL to high.

This makes the engine exit the IDLE state and enter into the OPERATING mode acquiring and decoding images.

To enter the LOW POWER mode from IDLE the engine takes less than 1 ms. If the scan engine is in LOW POWER mode, a LOW POWER to IDLE transition is required for resuming normal operation before going to any other mode.

After enter IDLE mode the engine can either parse DESP commands or respond to the interface signals TRIG_CTRL and AIM_CTRL.

In AIMING mode, only the laser pointer is activated while the engine remains idle with no illuminator nor decoding. This mode is useful to aim at the target before decoding.

To activate only the aiming system, the host should operate AIM_CTRL signal when the engine is in IDLE mode. The engine remains in IDLE mode until the TRIG_CTRL is activated.

The engine can be configured to use AIM_CTRL and TRIG_CTRL independently

Communication

The serial communication between the host and the engine occurs using the selected interface (UART or any USB except USB keyboard) with the default settings of: baud rate 115.2k, 8 data bits, No parity, 1 stop bit.

The decoded data is sent through the selected communication interface (UART, USB-COM and USB-OEM configurations only).

For controlling the scan engine the protocol used is the Decoded Engine Serial Protocol (DESP). DESP protocol can be used to start/stop operation and get the decoded result. It is also used to manage the configuration.

Please refer to Decoded Engine Serial Protocol Specification for detailed information.

If USB Keyboard interface is used, the engine only sends decoding results as a normal keyboard output, so it cannot receive any data or commands from the host.

If USB Composite interface is used, the engine sends decoding results as a normal keyboard output and it also opens a USB-COM port for configuration or communication with the host using DESP protocol.

Appendix A
Technical Specifications

This section lists the technical specification of the DE2171 engine, including reading performance.

Item	Description
Physical Characteristics	
Dimensions	**Nominal size:** Width 1.50"/38.00 mm Height 0.79"/20.00 mm Depth 1.44"/36.50 mm **Maximum size:** Width 1.52"/38.50 mm Height 0.79"/20.00 mm Depth 1.44"/36.50 mm
Weight	61 g / 2.15 ounces
Interface	Camera port and communication on a 27 pin ZIF Connector
Electrical Characteristics See "Power Consumption Details" on page 24 for more information.	
Current	Values at 23°C – default configuration: Max. Operating (RMS): < 320 mA at VCC = 5V < 500mA at VCC = 3.3V Standard Operation (Typical RMS): 250 mA Idle (Typical – RMS): 90 mA at VCC = 5V 100 mA at VCC = 3.3V Low Power (RMS): < 1.5 mA Surge Current Peak (at VCC = 5V): < 500 mA for t <0.15 ms that might occur in some conditions (see table 9)
Input Voltage	Values at 23°C: – VCC: 3.0V to 5.5V – VCC_IO: 1.7V to 3.6V – VCC_ILLUM_SYS: 3.0V to 5.5V See "Supply Voltages and I/O levels" on page 21 for details.

Item	Description
Performance Characteristics	
Image Sensor	MP: 1280x960 pixels
Light Source	Illumination: 2 LEDs Aiming: 650nm VLD
Field of View	14°H x 10.5°V
Print Contrast Minimum	20% minimum contrast
Scanning Angles See Definition of Scanning Angles on page 23 for additional information.	
Roll Angle	Up to ± 180°
Pitch Angle	± 60°
Skew Angle	± 60°
Minimum Element Width	1D Linear: 2.5 mils PDF: 3 mils Datamatrix: 5 mils

DE2171-AF	Depth of Field[1]	Typical [2]		Guaranteed	
	Resolution [mils]	Dmin [cm]	Dmax [cm]	Dmin [cm]	Dmax [cm]
Code 39	3	15	95	20	80
Code 39	20	–	500	–	450
EAN13	13	–	300	–	250
Code 128	40	–	850	–	750
Code 128	100	–	2000	–	1800
Datamatrix	10	–	100	–	80
Datamatrix	55	–	550	–	500
Datamatrix	100	–	1000	–	850

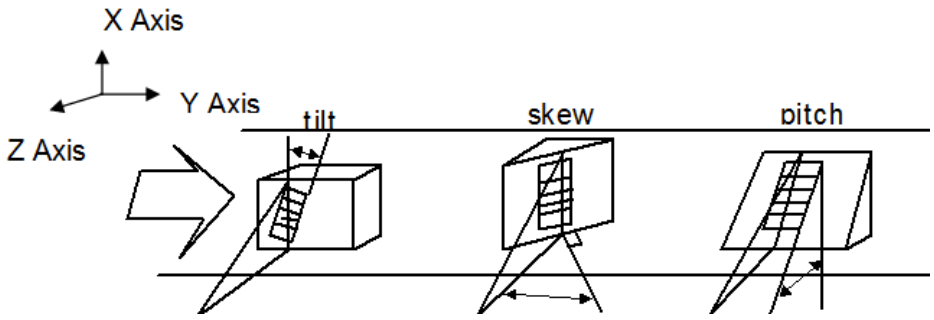
1. All labels grade A, ambient light level 300lux, pitch angle 10°, tilt angle 10°, skew angle 0°, room temperature 20°C.
2. If not declared Limited by Field of View.

Item	Description
User Environment	
Operating Temperature	Operating: -20 to 55°C / -4 to 131°F
Storage Temperature	Storage / Transport: -40 to 70°C / -40 to 158°F
Humidity (non-condensing)	95%
Mechanical Shock	2000 G ± 5% applied via any mounting surface at 23° C for a period of 0.45 ± 0.05 ms
Ambient Light Immunity	Up to 100,000 Lux
ESD Level	EN 61000-4-2 +/-2.0KV Air Discharge @ connector +/-1.0KV Contact Discharge @ chassis
Regulatory	
Aiming System (laser)	EN/IEC 60825-1:2007 and EN/IEC 60825-1:2014 (class 2) 21 CFR 1040 (CDRH) (class II)
TOF	EN/IEC 60825-1:2007 and EN/IEC 60825-1:2014 (class 1)
Illumination System (2 LEDs)	EN/IEC 62471 Exempt Risk Group
Environmental	RoHS compliant

Definition of Scanning Angles

Skew, Pitch, Roll Angle testing is based on ISO 15423 specifications.

Figure 15. ISO15423 angle definition



Reading distances are measured along Z-axis.

Power Consumption Details

While operating, the engine switches between different working modes. Each mode is characterized by a specific power consumption level.

Low Power	The engine is in sleep (minimum power consumption).
Idle	The engine is active, waiting for commands and ready to start an acquisition.
Operating	The engine is acquiring and streaming images to the host. Power consumption depends on the configuration of the engine.

Assuming the system is at 23°C and all three power supplies are at 3.3V, the typical current absorption is reported in the table below (engine parameters set at factory default).

Table 9. - Typical RMS Current Consumption

DE2171 status	Current Consumption	Conditions
Low power	< 1.5 mA	Temperature 23°C Illumination lamp duration 13 ms AIM laser-on duration 6 ms VCC = 3.3V VCC_IO = 3.3V VCC_ILLUM = 3.3V
Idle	100 mA	
Image Acquisition (Operating)	210 mA	
Illumination Enabled factory default	360 mA	
Illumination Enabled and AIM Enabled factory default timing	370 mA	
Maximum Operating Current	470 mA	
Maximum surge current	Peak < 670 mA for less than 150 us	During motor movements

Appendix B
Engine Video Format

This appendix describes details related to the video port of the engine, the image format and the related timing.

Sensor Data Format

The Datalogic DE2171 engine is based on the AR0135CS monochrome image sensor.

Figure 16 and Figure 17 below show the pixel array description and the spatial illustration of image readout.

Figure 16. - Pixel array description

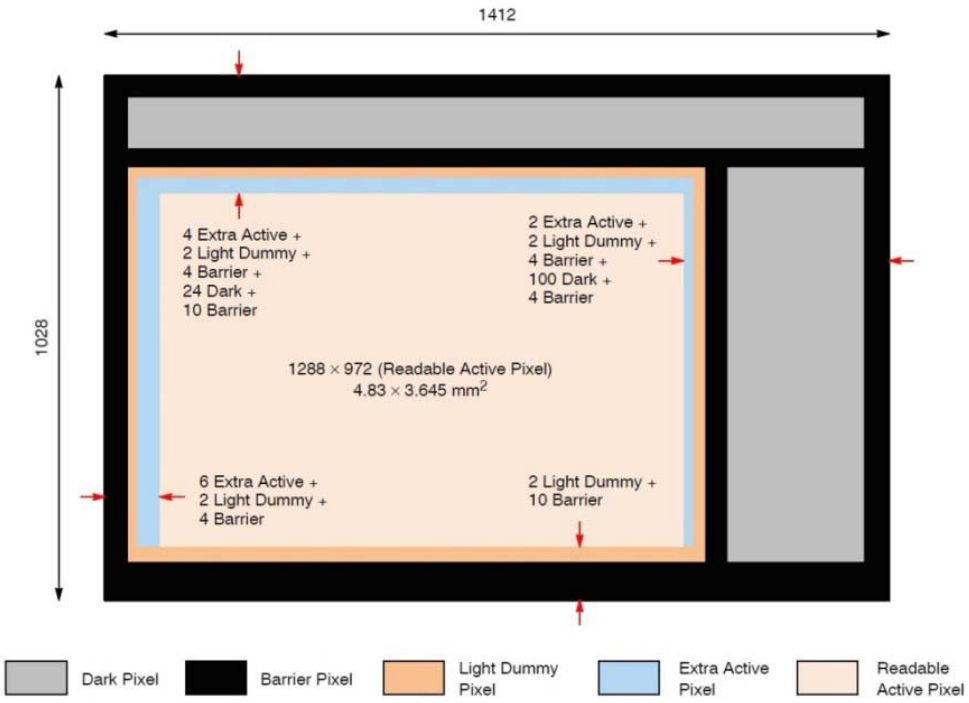
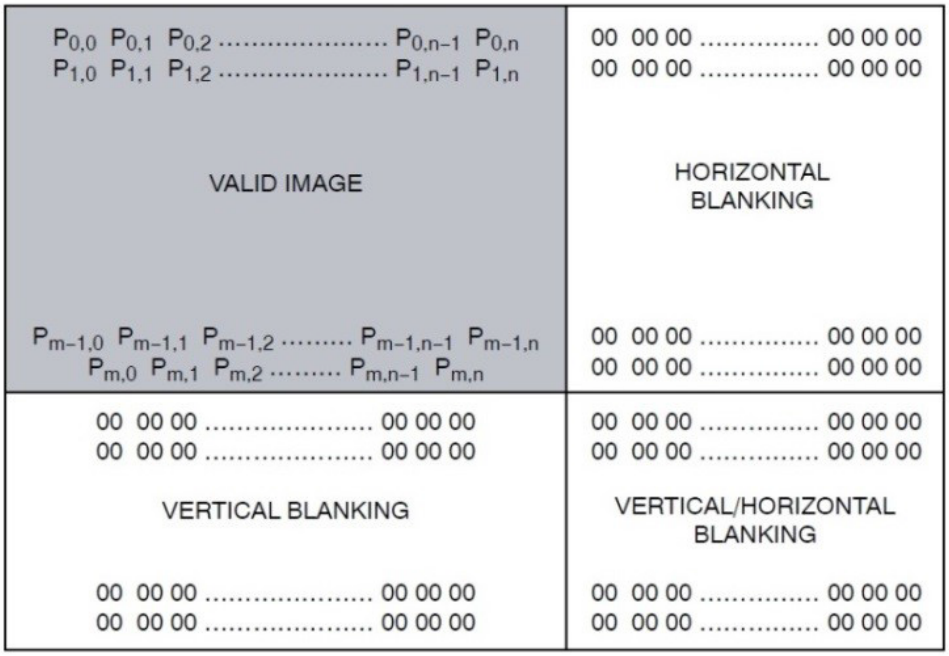


Figure 17. - Image Readout Spatial Illustration characterizing the progressive scan mode



MIPI-CSI2 Timing Parameters

If the MIPI-CSI2 interface is enabled, the data output of the sensor is serialized and sent via CSI2 protocol with the differential clock lane (MIPI CLKP, CLKN) and the differential data lane (MIPI DP, DN). When a data packet is to be transmitted, the MIPI interface works in differential High Speed mode (with a typical clock frequency of 296 MHz), otherwise it is in single ended low power mode. High speed data packets are sent for transmitting serialized image data (start/end of frame and pixels of each line).

Clock frequency at Tamb=25°C may vary of a 2% amount with respect to the typical value; moreover, in particular condition at extreme working temperatures there can be a maximum Pixel Clock frequency variation of up to a +6% value @ Tamb=-30°C and of a -3% value @Tamb=60°C.

Table 10 - MIPI CSI2 Timing

MIPI Parameter	Description	Typical Value
HS-CLH	High Speed transmission Clock frequency.	296 MHz
TCLK-POST	Time that High Speed Clock continues after all Data Lanes are in Low Power.	174 ns
TCLK-PRE	Time that High Speed Clock is driven before any Data Lane switch from Low Power to High Speed.	16 ns
TCLK-PREPARE	Time for data Lane signals both driven to Low Power 0 (LP-00) before entering HS mode (HS-0).	53 ns
TCLK-TRAIL	Time that Clock HS-0 state is driven after the last Clock transition of a High Speed burst.	70 ns
TCLK-PREPARE + TCLK-ZERO	TCLK-PREPARE + time that the transmitter drives the HS-0 state prior to starting the High Speed Clock.	335 ns
THS-PREPARE	Time that the transmitter drives the Data Lane LP-00 Line state immediately before the HS-0 Line state starting the High Speed transmission.	53 ns
THS-PREPARE + THS-ZERO	THS-PREPARE + time that the transmitter drives the HS-0 state prior to transmitting the High Speed Datapacket.	178 ns
THS-TRAIL	Time that Data HS-0 or HS-1 (depending on last transmitted bit) state is driven after the last payload bit of a High Speed.	80 ns
TLP-01	Transmitted length of any Low-Power LP-01 state period.	68 ns
THS-EXIT (Clock)	Time that of the Clock LP-11 state following a HS burst (varies if sensor Horizontal Blanking is modified).	1836 ns

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