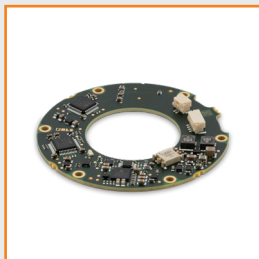


AksIM-4[™] HIPERFACE DSL[®]

application and integration guide

Abstract: This application note provides detailed guidance on the installation, configuration, operation, and diagnostics of the AksIM-4[™] HIPERFACE DSL[®] off-axis absolute magnetic encoder. It expands upon the standard datasheet by describing system architecture, resource database access, and custom resource implementation. Practical information is included to support integration, including calibration procedures, signal monitoring, and error handling. The document is intended for developers, system integrators and advanced users working with HIPERFACE DSL[®]-based encoder systems in industrial automation and robotics applications.

Related products



AksIM-4[™] HIPERFACE DSL[®]
off-axis rotary absolute
magnetic encoder

Introduction

Objective

The purpose of this document is to provide additional information for users, integrators, or developers utilising the AksIM-4™ HIPERFACE DSL® (hereinafter referred to as AksIM HDSL) encoder system. It includes information on installation, calibration, usage, and diagnostics.

Refer to the product specific documentation available at [RLS Media center](#) or [contact RLS](#).

Scope

This document applies only to the AksIM HDSL variant of RLS d.o.o. encoders. For other AksIM or RLS products, refer to the product-specific documentation available online or contact RLS d.o.o.

Glossary

D/R	Direct / read
D/W	Direct / write
HDSL®	High-performance Digital Servo Link
I/R	Indirect / read
I/W	Indirect / write
MCU	Microcontroller unit (also referred to as microprocessor)
MFB	Motor feedback; SICK specific terminology to denote a HDSL slave device as a whole; MFB MCU refers to the specific MCU of AksIM HDSL responsible for resource database management and error reporting.
RA	Register access
RDB	Resource database
SFE	Sensor front end; part of AksIM HDSL responsible for capturing and decoding position information, running on a dedicated MCU

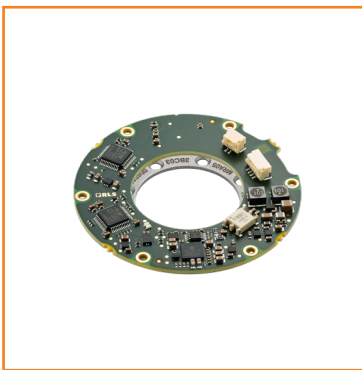
System overview

The AksIM HDSL is an absolute, quasi-true multiturn rotary magnetic encoder that provides position information to control devices using SICK HIPERFACE DSL® technology [1]. It is primarily intended for use in industrial automation and robotics applications, although it may also be used in any suitable environment supporting HIPERFACE DSL®.

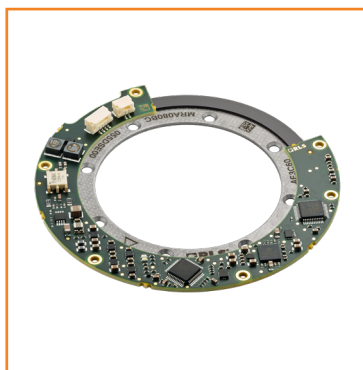
The encoder system consists of an information carrier ring and a sensing PCB.

The AksIM HDSL is currently available in two sizes, with diameters of 53 mm or 80 mm.

For more information, including mounting dimensions, environmental conditions, and electrical parameters, refer to the AksIM HDSL datasheet available at [RLS Media center](#).



Size 53 mm



Size 80 mm

Architecture

The system architecture follows the prescribed SICK structure, as detailed in [1].

Resource database

The Hiperface DSL® resource database enables users of HDSL devices to access information about the motor feedback system using the long message protocol.

Resource index

List of all supported RDB entries in the AksIM HDSL

RID	Name	Time overrun [ms]	Description
0x000	ROOT	25	Top/root node of the resource tree
0x001	IDENT	25	Identification resources access node
0x002	MONITOR	25	Monitoring resources access node
0x003	ADMIN	25	Administration resources access node
0x005	DATA	25	File system access node
0x006	SENSHUB	25	MFB I/O access node
0x007	PRODUCTION	25	Production-dependent resource access node
0x080	ENCTYPE	25	Basic encoder properties
0x081	RESOLUTN	25	Encoder single-turn resolution
0x082	RANGE	25	Encoder multiturn range
0x083	TYPECODE	25	MFB type code name
0x084	SERIALNO	25	HDSL slave product serial number
0x085	FWREVNO	25	HDSL slave product firmware and hardware revision number
0x086	FWDATE	25	HDSL slave product firmware date
0x087	EESIZE	25	User file storage non-volatile memory size
0x0C0	TEMPRNG	25	HDSL slave product minimum and maximum temperature value
0x0C1	TEMPRTUR	25	Current temperature measured at the position sensor of the MFB
0x0C4	SUPRANGE	25	Minimum and maximum permitted supply voltage values
0x0C5	SUPVOLT	25	Measured supply voltage of DSL MFB
0x0C6	SPEEDRNG	25	Maximum permitted encoder rotation speed
0x0C7	SPEED	25	Measured velocity (RPM)
0x0CC	ERRORLOG	50	System error log
0x0D6	SIGLVL	25	Signal level (RA)
0x0D7	DETSTAT	25	Detailed status (RA)
0x0D8	MINDIST	25	Minimum distance to decoding warning threshold
0x100	RESET	25	MFB processor reset or shutdown
0x101	SETPOS	75	Position offset setting
0x104	SETACCES	25	RDB access levels governing resource availability
0x105	CHNGEKEY	150	Access key (password) change for access level setting
0x108	FACTRST	2000	Factory reset of file system, SFE, or entire encoder to factory settings
0x109	ENCIDENT	60	User-defined MFB index
0x113	MT_INFO	25	Multiturn specific data and functionality (RA)

table continued

RID	Name	Time overrun [ms]	Description
0x114	SELFCAL	2000	Self-calibration specific data and functionality (RA)
0x115	CFGBLOCK	25	Encoder configuration block (RA)
0x130	LOADFILE	2000	Existing file loading
0x131	RWFILE	2000	Existing file read/write
0x132	FILESTAT	2000	Loaded file status
0x133	MAKEFILE	2000	File creation, status modification, or deletion
0x134	DIR	2000	File count, available memory, and user file names
0x180	EOLT	25	Reserved for internal factory use
0x200	ACCESSIO	25	MFB I/O access (external temperature sensor resistance value in ohms)

Detailed descriptions of AksIM HDSL custom resources

This section provides detailed descriptions of custom resources implemented in the AksIM HDSL. Resources not described here are mandatory resources defined by SICK. Their descriptions can be found in the [SICK HIPERFACE DSL® documentation](#).

Error log

This resource maintains a log of the last eight errors detected by the MFB. If the number of recorded errors exceeds this limit, the oldest entries are overwritten (first-in-first-out).

For each error entry, the following seven parameters are captured at the time the error occurs and stored in the error log:

1. Error code (see [Error code definitions](#))
2. Additional error code (see [Additional code definition](#))
3. Rotational speed (min^{-1})
4. Internal supply voltage (mV)
5. MFB initialisation status code (see [Initialisation status definition](#))
6. Temperature (resolution: 0.1 °C)
7. Time of occurrence (minutes since the current power-on cycle)

See also [Error log entry structure and definition](#).

Error log resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x0CC
Address	Data storage address
Start	N/A
Size	8
W	15
R	0
Timeout	MFB-specific
Name	"ERRORLOG"
Resource data type	struct 16 bytes (32)
Profile requirement	Optional

Error log resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"ERRORLOG"	Resource name
0001h	2	D/R	-	8	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	15	Write access level
0004h	2	D/R	-	50	Timeout
0005h	2	D/R	-	32	Data type: struct 16 bytes
0000h	0, 2, 4, 8	I/R	-	"xxxxxxx"	Number of valid entries (max. 8)
0001h	8	I/R	-	"xxxxxxx"	First 8 bytes of newest entry
0101h	8	I/R	-	"xxxxxxx"	Second 8 bytes of newest entry
0002h	8	I/R	-	"xxxxxxx"	First 8 bytes of second entry
0102h	8	I/R	-	"xxxxxxx"	Second 8 bytes of second entry
0003h	8	I/R	-	"xxxxxxx"	First 8 bytes of third entry
0103h	8	I/R	-	"xxxxxxx"	Second 8 bytes of third entry
0004h	8	I/R	-	"xxxxxxx"	First 8 bytes of fourth entry
0104h	8	I/R	-	"xxxxxxx"	Second 8 bytes of fourth entry
0005h	8	I/R	-	"xxxxxxx"	First 8 bytes of fifth entry
0105h	8	I/R	-	"xxxxxxx"	Second 8 bytes of fifth entry
0006h	8	I/R	-	"xxxxxxx"	First 8 bytes of sixth entry
0106h	8	I/R	-	"xxxxxxx"	Second 8 bytes of sixth entry
0007h	8	I/R	-	"xxxxxxx"	First 8 bytes of seventh entry
0107h	8	I/R	-	"xxxxxxx"	Second 8 bytes of seventh entry
0008h	8	I/R	-	"xxxxxxx"	First 8 bytes of oldest entry
0108h	8	I/R	-	"xxxxxxx"	Second 8 bytes of oldest entry
0001h - 7FFFh	0 - 8	I/R		Error: 14 40	Invalid offset
0000h - 7FFFh	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted

Signal level

This resource indicates the encoder signal level value.

Signal level resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x0D6
Address	Data storage address
Start	N/A
Size	4
W	15
R	0
Timeout	MFB-specific
Name	"SIGLVL"
Resource data type	Unsigned 32-bit (5)
Profile requirement	Optional

Signal level resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"SIGLVL"	Resource name
0001h	2	D/R	-	4	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	15	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	5	Data type: u32
0000h	4	I/R	-	"xxxxxxx"	Signal level value
0000h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0000h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0001h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0001h - 7FFFh	0 - 8	I/W	"xx"	Error: 13 40	Offset value too high

Speed

This resource provides the encoder's velocity value.

Speed resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x0C7
Address	Data storage address
Start	N/A
Size	2
W	15
R	0
Timeout	MFB-specific
Name	"SPEED"
Resource data type	Unsigned 16-bit (4)
Profile requirement	Optional

Speed resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"SPEED"	Resource name
0001h	2	D/R	-	2	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	15	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	4	Data type: u16
0000h	2	I/R	-	"xxxx"	Speed value in rpm
0000h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0000h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0001h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0001h - 7FFFh	0 - 8	I/W	"xx"	Error: 13 40	Offset value too high

Detailed status

This resource provides the encoder's persistent detailed status.

Detailed status resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x0D7
Address	Data storage address
Start	N/A
Size	8
W	0
R	0
Timeout	MFB-specific
Name	"DETSTAT"
Resource data type	Unsigned 32-bit (5)
Profile requirement	Optional

Detailed status resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"DETSTAT"	Resource name
0001h	2	D/R	-	4	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	0	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	5	Data type: u32
0000h	4	I/R	-	"xxxxxxx"	Persistent detailed status
0000h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0000h	0	I/W	-	-	Reset persistent detailed status
0000h	2, 4, 8	I/W	"xxxxxxx"	Error: 11 40	Incorrect length
0001h	4	I/R	-	"xxxxxxx"	Detailed status
0001h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0001h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0002h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0002h - 7FFFh	0 - 8	I/W	"xx"	Error: 13 40	Offset value too high

Minimal distance from decoding warning threshold

This resource provides the encoder's minimum distance between the decoding point and the decoding warning threshold. Both persistent and non-persistent values can be read. The persistent value represents the largest recorded value since the last power cycle, while the non-persistent value represents the most recent measurement.

Minimal distance from decoding warning threshold resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x0D8
Address	Data storage address
Start	N/A
Size	4
W	0
R	0
Timeout	MFB-specific
Name	"MINDIST"
Resource data type	struct 4 bytes (20)
Profile requirement	Optional

Minimal distance from decoding warning threshold resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"MINDIST"	Resource name
0001h	2	D/R	-	4	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	0	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	20	Data type: struct 4 bytes
0000h	2	I/R	-	"xxxx"	Current minimum decoding distance
0000h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0000h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0001h	2	I/R	-	"xxxx"	Persistent minimum decoding distance
0001h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0001h	2	I/W	"xxxx"	-	Write persistent minimum decoding distance
0001h	0, 4, 8	I/W	"xx"	Error: 11 40	Incorrect length
0002h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0002h - 7FFFh	0 - 8	I/W	"xx"	Error: 13 40	Offset value too high

Multiturn information

This resource provides the encoder's multiturn-specific data and functionality.

After writing to the multiturn counter preset (offset 0), execute the command "Apply MT counter" at offset 2.

After writing to the multiturn error arc length, the encoder configuration must be saved using the command in the "CFGBLOCK" resource (offset 3). See [Configuration data block](#) on page 14.

Multiturn information resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x113
Address	Data storage address
Start	N/A
Size	6
W	0
R	0
Timeout	MFB-specific
Name	"MT_INFO"
Resource data type	struct 6 bytes (22)
Profile requirement	Optional

Multiturn information resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"MT_INFO"	Resource name
0001h	2	D/R	-	6	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	0	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	22	Data type: struct 6 bytes
0000h	4	I/R	-	"xxxxxxxx"	Multiturn counter preset
0000h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0000h	4	I/W	"xxxxxxxx"	-	Write multiturn counter preset
0000h	0, 2, 8	I/W	"xxxxxxxx"	Error: 11 40	Incorrect length
0001h	2	I/R	-	"xxxx"	Multiturn error arc length
0001h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0001h	2	I/W	"xxxx"(<=90)	-	Write multiturn error arc length
0001h	2	I/W	"xxxx"(>90)	Error: 15 40	Invalid data (maximum value is 90)
0001h	0, 4, 8	I/W	"xxxx"	Error: 11 40	Incorrect length
0002h	8	I/W	""	-	Apply MT counter (command)
0002h	2, 4, 8	I/W	"xxxx"	Error: 11 40	Incorrect length
0002h	0 - 8	I/R	-	Error: 11 41	Read access not permitted
0003h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0003h - 7FFFh	0 - 8	I/W	"xxxx"	Error: 13 40	Offset value too high

Self-calibration

This resource provides the encoder's self-calibration-specific data and functionality.

Self-calibration resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x114
Address	Data storage address
Start	N/A
Size	16
W	0
R	0
Timeout	MFB-specific
Name	"SELF CAL"
Resource data type	struct 16 bytes (32)
Profile requirement	Optional

Self-calibration resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"SELF CAL"	Resource name
0001h	2	D/R	-	0	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	0	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	1	Data type: Void
0000h	4	I/R	-	"xxxxxxx"	Self-calibration status
0000h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0000h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0001h	2	I/R	-	"xxx"	Partial arc length
0001h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0001h	2	I/W	"xx"	-	Write partial arc length
0001h	0, 4, 8	I/W	"xxx"	Error: 11 40	Incorrect length
0002h	2	I/R	-	"xxx"	Calibration timeout
0002h	0, 4, 8	I/R	-	Error: 11 41	Incorrect length
0002h	2	I/W	"xxx" (<=40)!	-	Write to calibration timeout
0002h	2	I/W	"xxx" (>40)	Error: 15 40	Invalid data (maximum value is 40)
0002h	0, 4, 8	I/W	"xxx"	Error: 11 40	Incorrect length
0003h	2	I/R	-	"xxx"	Ring eccentricity shift - [μm]
0003h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0003h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0004h	2	I/R	-	"xxx"	Ring eccentricity angle - [°]
0004h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0004h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0005h	2	I/R	-	"xxx"	Readhead radial shift - [μm]
0005h	0, 4, 8	I/R	-	Error: 11 40	Incorrect length
0005h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0006h	0	I/W	""	-	Start self-calibration (command)
0006h	2, 4, 8	I/W	"xxx"	Error: 11 40	Incorrect length
0006h	0 - 8	I/R	-	Error: 11 41	Read access not permitted
0007h	2	I/R	""	"000x"	Self-calibration finished
0007h	0, 4, 8	I/R	""	"xx"	Incorrect length
0007h	0 - 8	I/W	"xxx"	""	Write access not permitted
0008h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0008h - 7FFFh	0 - 8	I/W	"xxx"	Error: 13 40	Offset value too high

Configuration data block

This resource provides the encoder's configuration-specific data and functionality.

Configuration data block resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x115
Address	Data storage address
Start	N/A
Size	12
W	0
R	0
Timeout	MFB-specific
Name	"CFGBLOCK"
Resource data type	struct 12 bytes (28)
Profile requirement	Optional

Configuration data block resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"CFGBLOCK"	Resource name
0001h	2	D/R	-	12	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	0	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	28	Data type: struct 12 bytes
0000h	4	I/R	-	"xxxxxxx"	Position filter value
0000h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0000h	4	I/W	"xxxxxxx"	-	Write position filter value
0000h	0, 2, 8	I/W	"xxxx"	Error: 11 40	Incorrect length
0001h	4	I/R	-	"xxxxxxx"	Position filter speed
0001h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0001h	4	I/W	"xxxxxxx"	-	Write position filter speed
0001h	0, 2, 8	I/W	"xxxx"	Error: 11 40	Incorrect length
0002h	4	I/R	-	"xxxxxxx"	Velocity filter value
0002h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0002h	4	I/W	"xxxxxxx"	-	Write velocity filter value
0002h	0, 2, 8	I/W	"xxxx"	Error: 11 40	Incorrect length
0003h	0	I/W	-	-	Save encoder configuration
0003h	2, 4, 8	I/W	"xxxx"	Error: 11 40	Incorrect length
0003h	0 - 8	I/R	-	Error: 11 41	Read access not permitted
0003h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0003h - 7FFFh	0 - 8	I/W	"xxxx"	Error: 13 40	Offset value too high

Factory reset

This resource provides functionality to reset the file system, reset the encoder to factory settings, or perform both operations.

Factory reset resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x108
Address	Data storage address
Start	N/A
Size	0
W	2
R	15
Timeout	MFB-specific
Name	"FACTRST"
Resource data type	Void (1)
Profile requirement	Optional

Factory reset resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"FACTRST"	Resource name
0001h	2	D/R	-	0	Data size
0002h	2	D/R	-	15	Read access level
0003h	2	D/R	-	2	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	1	Data type: Void
0000h	8	I/W	"xxxxxxx" (acc.lvl < 2)	Error: 12 41	Write access denied
0000h	8	I/W	"RESETUFS" (acc.lvl >= 2)	-	Reset file system to factory settings
0000h	8	I/W	"RESETALL" (acc.lvl >= 2)	-	Reset all to factory settings
0000h	8	I/W	"RESETENC" (acc.lvl >= 2)	-	Reset SFE to factory settings
0000h	8	I/W	"xxxxxxx" (acc.lvl >= 2)	Error: 15 40	Invalid data
0000h	0 - 4	I/W	"xxxxxxx"	Error: 40 11	Incorrect length
0000h - 7FFFh	0 - 8	I/R	-	Error: 11 41	Read access not permitted
0000h - 7FFFh	0 - 8	I/W	-	Error: 13 40	Offset value too high

EOLT

This resource is intended for internal production testing and is protected by access level 5.

External temperature sensor resistance value

This resource provides the external temperature sensor value in ohms.

External temperature sensor value resource properties

RDB entry qualifier	Value
Resource type	Function pointer (7)
RID	0x200
Address	Data storage address
Start	N/A
Size	4
W	15
R	0
Timeout	MFB-specific
Name	"ACCESSIO"
Resource data type	Unsigned 32-bit (5)
Profile requirement	Optional

External temperature sensor value resource structure

Offset	Length	Mode	Data bytes	Response	Description
0000h	8	D/R	-	"ACCESSIO"	Resource name
0001h	2	D/R	-	4	Data size
0002h	2	D/R	-	0	Read access level
0003h	2	D/R	-	15	Write access level
0004h	2	D/R	-	xx	Timeout
0005h	2	D/R	-	5	Data type: u32
0000h	4	I/R	-	"xxxx"	Sensor reading [Ω]
0000h	0, 2, 8	I/R	-	Error: 11 40	Incorrect length
0000h	0 - 8	I/W	"xx"	Error: 10 41	Write access not permitted
0001h - 7FFFh	0 - 8	I/R	-	Error: 13 40	Offset value too high
0001h - 7FFFh	0 - 8	I/W	"xx"	Error: 13 40	Offset value too high

Installation and calibration

Signal level

Using the signal level information available in the resource database (see [Signal levels](#)), users can estimate the ride height (air gap), defined as the distance between the magnetic surface of the ring and the sensor.

Also see the AksIM HDSL datasheet available at [RLS Media center](#).

Distance from decoding warning

AksIM HDSL detects when the ride height approaches the decoding limits. If these limits are exceeded, position decoding fails and an error is raised. A warning is issued slightly before these limits are reached. Resource 0x0D8 provides data describing the distance to the decoding warning threshold in μm . See [Minimal distance from decoding warning threshold resource structure](#) on page 10.

This value can be used to determine the available margin before decoding issues occur.

The resource contains both the current distance to the decoding warning threshold (offset 0000h I/R) and a persistent value representing the smallest recorded distance since the last power cycle (offset 0001h I/W). The persistent value can be reset by writing to offset 0001h I/W or by power-cycling the encoder.

Self-calibration

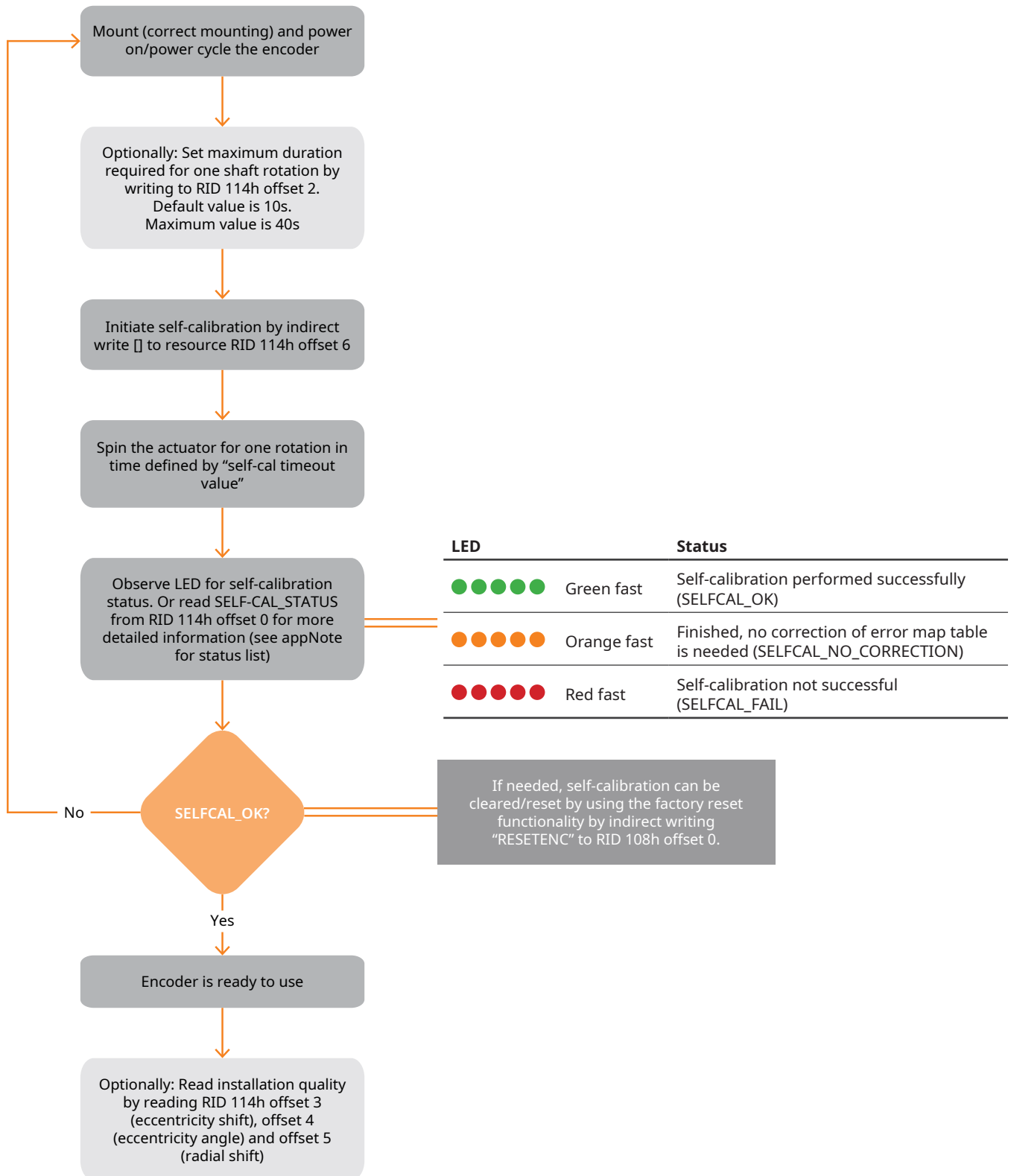
Self-calibration is a routine that compensates for the effects of eccentricity in the encoder's position measurement. It is recommended to run this routine after the encoder is mounted to maximise performance.

Self-calibration resource structure

See [Self-calibration resource structure](#) on page 13.

Self-calibration routine procedure

The following flowchart illustrates the self-calibration procedure:



Self-calibration status list

This section lists all possible self-calibration statuses with brief descriptions. The status can be read from the self-calibration RDB resource offset 0 (see [Self-calibration](#) on page 12).

Status type	Name	Bit mask	Description
Counter	SELCAL_COUNTER_0	0x00000001	Self-calibration counter is incremented at the end of the self-calibration procedure
Counter	SELCAL_COUNTER_1	0x00000002	
General	SELCAL_OK	0x00000010	Self-calibration successfully completed
General	SELCAL_FAIL	0x00000040	Self-calibration failed
Detailed	SELCAL_DATA_COLLECT_TIMEOUT	0x00000100	Self-calibration duration exceeded the timeout threshold
Detailed	SELCAL_CYCLE_ERROR	0x00000200	Encoder was in an error state when calibration started; procedure aborted
Detailed	SELCAL_CALC_NOK_NUM_ERROR	0x00001000	Numerical error during data processing
Detailed	SELCAL_CALC_NOK_EC_HIGH	0x00002000	Eccentricity is very high
Detailed	SELCAL_CALC_NOK_RADDISP_HIGH	0x00008000	Radial displacement is very high
Detailed	SELCAL_PARAMETERS_NOT_DEFAULT	0x00100000	Error map is not in the default state (self-calibration has been successfully performed). Comparison is performed at power-up and after each write to flash
Detailed	SELCAL_PARAMETERS_WRITE_ERR	0x00200000	Parameters could not be saved to non-volatile memory (system fault)

Error reporting and diagnostics

HDSL error registers (ENC_ST)

The AksIM HDSL maps its error states to the HDSL error registers.

Address - Name register	Bit	Fault description	SFE status bit	Persistence	Controller reaction
ENC_ST0	0	Protocol reset indication	-	-	-
	1	Acceleration overflow error	-	-	-
	2	Reserved	-	-	-
	3	Not used (always 0)	-	-	-
	4	Not used (always 0)	-	-	-
	5	Not used (always 0)	-	-	-
	6	Not used (always 0)	-	-	-
	7	Not used (always 0)	-	-	-
ENC_ST1	0	Not used (always 0)	-	-	-
	1	Not used (always 0)	-	-	-
	2	Not used (always 0)	-	-	-
	3	Multiturn counter mismatch. Encoder rotated more than $\pm 90^\circ$ during power-down. Cycle power to clear this error.	9	p	SW reset of encoder
	4	Not used (always 0)	-	-	-
	5	Not used (always 0)	-	-	-
	6	Not used (always 0)	-	-	-
	7	Not used (always 0)	-	-	-
ENC_ST2	0	Not used (always 0)	-	-	-
	1	Not used (always 0)	-	-	-
	2	Not used (always 0)	-	-	-
	3	Not used (always 0)	-	-	-
	4	Internal SPI communication error	-	np	Clear error by writing 0 into ENC_ST
	5	Internal I2C communication error - Not used (always 0)	-	np	-
	6	Internal system error (Host MCU diagnostics or SFE identification error)	-	np	SW reset of encoder
	7	Not used (always 0)	-	-	-

table continued

Address - Name register	Bit	Fault description	SFE status bit	Persistence	Controller reaction
ENC_ST3	0	Temperature out of range. The readhead temperature is out of the specified range (Tmin, Tmax).	14	np	Clear warning by writing 0 into ENC_ST
	1	Not used (always 0)	-	-	-
	2	Power supply is out of range	-	np	Clear warning by writing 0 into ENC_ST
	3	High speed warning. Speed is above the threshold	10	np	Clear warning by writing 0 into ENC_ST
	4	Not used (always 0)	-	np	Clear warning by writing 0 into ENC_ST
	5	Position decoding error	8, 7, 6, 5	np	Clear warning by writing 0 into ENC_ST
	6	SFE internal error / inconsistent calibration table	4, 3, 2	np	Clear warning by writing 0 into ENC_ST
	7	Not used (always 0)	-	-	-
ENC_ST4	0	Invalid access	-	-	-
	1	Access denied	-	-	-
	2	Resource access error	-	-	-
	3	File access error	-	-	-
	4	Not used (always 0)	-	-	-
	5	Not used (always 0)	-	-	-
	6	Not used (always 0)	-	-	-
	7	Not used (always 0)	-	-	-
ENC_ST5	0 - 7	Not used (always 0)	-	-	-
ENC_ST6	0 - 7	Not used (always 0)	-	-	-
ENC_ST7	0 - 7	Not used (always 0)	-	-	-

Detailed status

The detailed status resource (see [Detailed status](#) on page 9) contains information on the diagnostics of the encoder's SFE. It is saved as a 16-bit word where each bit corresponds to a specific SFE error state.

Bit number	Description of error/warning	Error/Warning	Clearing
15	Reserved		
14	Temperature out of range. The readhead temperature is outside the specified range (Tmin, Tmax)	Warning	When absent
13	Signal amplitude low. The distance between the readhead and the ring is too large	Warning	When absent
12	Signal amplitude high. The readhead is too close to the ring	Warning	When absent
11	Signal decoding below threshold; position decoding may fail	Warning	When absent
10	High-speed warning. Speed is above the threshold	Warning	When absent
9	Multiturn counter mismatch. Encoder rotated more than $\pm 90^\circ$ during power-down. Cycle the power to clear this error	Error	Upon reset
8	Acceleration error. Position data changed unexpectedly due to stray magnetic fields or metal particles between the readhead and the ring	Error	At communication
7	Magnetic pattern error. Caused by stray magnetic fields, contamination, or incorrect radial positioning	Error	When absent
6	Signal lost. The readhead is misaligned or the ring is damaged	Error	When absent
5	Signal amplitude too high. External magnetic field present	Error	When absent
4	System error. Internal circuitry malfunction; may require power cycling with rise time < 20 ms	Error	When absent
3	Internal power supply error	Error	When absent
2	System error. Inconsistent calibration data detected; may require power cycling with rise time < 20 ms	Error	Upon reset
1	Reserved		
0	Reserved		

Detailed status is available in both current or persistent variants. The persistent variant holds all errors that have occurred since the last power cycle, while the current variant includes only active, uncleared errors.

Error log

See [Error log](#) on page 5.

Additional features

External temperature sensor

The AksIM HDSL includes a 2-pin connector for an external temperature sensor. One example of usage is to sense winding temperature in electric motors. Supported sensors include Pt1000, LPTC600, KY84-130, or any sensor with a resistance in the range 0-5 kΩ. The AksIM HDSL measures resistance only and does not convert this value into temperature. The measured value can be read from the RDB (see [External temperature sensor resistance value](#) on page 16).

The sensing circuitry is tuned to this range but is not calibrated.

Serial number

Due to the discrepancy between the RLS serial number format and the limitations of the RDB "SERIALNO" resource (maximum length of 10 characters), a coding/decoding system is used. The serial number code read from RDB RID 0x084 must be decoded using Base62 encoding to obtain the 16-digit RLS format serial number. The Base62 alphabet is defined as 0-9A-Za-z. The decoded result is an integer number expressed in base 10.

The RLS 16-digit serial number can be read from the 2D code on the encoder readhead PCB.

An example of serial number decoding is shown using the recommended online tool available at [Base62 Encoding - Online Base 62 Decoder, Encoder, Translator](#):



The screenshot displays the 'BASE62 ENCODING' website. On the left, a search bar shows 'e.g. type 'random'' and a 'Results' section displays the decoded value '1002125178000488' for the input '4aYyUiL6W'. On the right, the 'BASE-62 DECODER' section shows the input '4aYyUiL6W' in a text box. Below the text box, the 'ALPHABET' is set to '0-9A-Za-z (by default)' and the 'RESULTS FORMAT' is set to 'Integer number (in base 10)'. A 'DECODE' button is visible. At the bottom, it says 'See also: Base64 Coding - Base 58'.

Base-62 decoding example.

References



[1] "SICK Hipurface DSL," [Online]. Available: <https://www.sick.com/ae/en/s/hiperface-dsl>

Head office

RLS Merilna tehnika d. o. o.

Poslovna cona Žeje pri Komendi
Pod vrbami 2
SI-1218 Komenda
Slovenia

T +386 1 5272100
E mail@rls.si
www.rls.si

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Document issues

Issue	Date	Page	Description
1	12. 5. 2026	–	New document

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